EUROMATH & EUROSCIENCE Conference 2020

11 – 15 March 2020 Thessaloniki, Greece

PROGRAMME AND ABSTRACTS BOOKLET

euroMath 2020 euroSCIENCE 2020 ASTUCON 2020

YOUNG RESEARCHERS
For students of age 9-18
MATHS & SCIENCE

www.euromath.org
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Under the Patronage of the Mayor of Thessaloniki Mr. Constantinos Zervas

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EUROPEAN STUDENT CONFERENCE IN MATHEMATICS and SCIENCE

Young Researchers, Mathematicians and Scientists of age 9-18

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11-15 March 2020, Thessaloniki, Greece

CONFERENCE PROGRAMME

ABSTRACTS BOOKLET

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ORGANIZERS

WITH THE SUPPORT OF

MESSAGE FROM THE PRESIDENT OF THE EUROPEAN MATHEMATICAL SOCIETY

Dear future scientists,

As president of the European Mathematical Society I welcome you to this year's Euromath/Euroscience Conference in Thessaloniki. I am really glad that so many of you have come and I truly regret that I cannot be here with you, but we have at the same time the meeting of the EMS presidents and the opening of the International Day of Mathematics.

I share with you the interest and the passion for mathematics and science because they are great fun and it is truly rewarding to be mathematician. I really enjoy what I am doing and hope that you will do so as well during this meeting. It is a remarkable intellectual pleasure to address scientific challenges and to figure out why things are the way they are, how to describe the world using abstract descriptions, how to play with the abstract formulations and how to bring them to use in applications. Whatever your favorite scientific field in the future will be, whether it is mathematics or any of the sciences, the experience that you will have when doing this is that it is one the greatest things that one can do in life. It is the perfect combination to do the things that you love and to make this your job, to do research and teaching and also to bring it to use for the well-being ofsociety.

This is the mathematics that I am doing. I always liked the beauty of mathematical structures, the rigor that you can prove whether things are right or wrong, but also to take the mathematics that I developed abstractly in my mind and to apply it in science or technology to create progress in industry. It is for me very rewarding to discuss with my colleagues for example an engineering problem, where things are stuck in the development and then to take in to an abstract mathematical framework, to see what I can do there and then help the colleagues to solve the problem in practice.

How can this be possible? Describing the world in an abstract framework typically makes it simpler, this is why mathematical language is the language of science, that is why Newton and Leibniz developed analysis or why the Greek mathematicians invented geometry. And the language is universal, all of you can use it in a similar way. Mathematics is international, it has no borders, no religious dogmas, and no place for belief, because things can and should beproved.

I hope that some of this spirit comes over you during these days, that you meet interesting new friends and experience the joy in solving problems and creating new worlds. I wish you a great and memorable time at Euromath/Euroscience Conference.

Prof. Volker Mehrmann
President – European Mathematical Society

EUROMATH & EUROSCIENCE 2020, ASTUCON 2020

Under the patronage of the Mayor of Thessaloniki

Opening Ceremony

16:30 – 18:00, Thursday, 12 March 2020
Place: Olympia B&C (Level 0)
Grand Hotel Palace, Thessaloniki, Greece
****

Music Programme

Greek Music=World Music
Performers: Alexia Tanouri (accordion, vocals) & Despina Kalantaridou (flute, vocals)

****

Welcoming address by the chair of the Organizing Committee

Prof. Gregoris A. Makrides,
Chair of the Organizing Committee of the Conference
President of the Cyprus Mathematical Society, President of the THALES Foundation
Member of the EMS Education Committee
*

Greetings

Prof. Volker Mehrmann
President of the European Mathematical Society
*
Prof. Hara Charalambous
Head of the School of Mathematics,
Aristotle University of Thessaloniki, Greece

Opening Greetings of the Conference

Mr Constantinos Zervas
Mayor of the City of Thessaloniki
****

Invited Opening Speech

"Maths is for the Future"
by prof. Mina Teicher, Emmy Noether Research Institute for Mathematics, Israel

Reception

Sweet Taste of Thessaloniki

EUROMATH & EUROSCIENCE 2020 – ASTUCON 2020 PROGRAMME

Wednesday, 11 March 2020 Lobby Area/Seros Space, Grand Hotel Palace, Thessaloniki, Greece		
All day	**Arrivals**	
14:00 – 19:00	**REGISTRATION** **Lobby Area/Seros Space**	**Registration for Conference participants and Competition Finalists** **MATH & SCIENCE Poster Design Competition - Submission of printed poster designs**
	19:00 – 20:00 **EUROMATH Advisory Board Meeting** **By invitation only** **Location: Seros Room (Level 0)**	**POSTER DESIGN EXHIBITION AREA** **Lobby Area Exhibition Space, near Seros Space**

Thursday, 12 March 2020 Grand Hotel Palace, Thessaloniki, Greece					
08:30 +	**REGISTRATIONS (Lobby Area /Seros Space):** For Conference participants and Competition finalists **MATH & SCIENCE Poster COMPETITION** Submission of printed poster designs				
Place	**Olympia B&C (Level 0)**	**Patoulidou A (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou B (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Christina Papadopoulou** **Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Christos Kitsios**	**Dimitrios Tsintsilidas**	**Ioannis Iakovidis** **Athanasios Koutsopagos**
09:30 – 09:45	**MP1** **DIABETES IS MATHEMATICS** Marija Švegović Centar Izvrsnosti, Koprivnica, Croatia	**MP16** **RATES AS A SOLUTION TO EVERYTHING** Yegor Kim, Pavel Burya, Konstantin Popov International School of Moscow, Russia	**WS2** (for 5-8 grades students) **PRACTICAL APPLICATION OF LINEAR DIOPHANTINE EQUATIONS WITH TWO UNKNOWNS** Sava Grozdev VUZF University	**WS5** (for all students) **KAHOOT QUIZ** Marina Furkes, Bojana Habek Gimnazija „Fran Galovic“ Koprivnica, Croatia	**SP1** **PHYSICS IN CARTOONS** Nikita Guz, Dohyun Lee International School of Moscow, Russia
09:45 – 10:00	**MP2** **MATH IN VUČEDOL CULTURE** Lea Smiljanec, Nera Tomrlin Centar Izvrsnosti, Koprivnica, Croatia	**MP12** **NAVIGATING THE WORLD** Innokentiy Kaurov International School of Moscow, Russia	**WS2** **PRACTICAL APPLICATION OF LINEAR DIOPHANTINE EQUATIONS WITH TWO UNKNOWNS**	**WS5** **KAHOOT QUIZ**	**SP17** **HISTORY, FUTURE AND STORY OF IVF** Maria Vilstrup Rygaards International School, Denmark

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Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Christina Papadopoulou** **Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Christos Kitsios**	**Dimitrios Tsintsilidas**	**Ioannis Iakovidis** **Athanasios Koutsopagos**
10:00 – 10:15	**MP17** **MATHEMATICS IN ART** Qishi Xie, Platon Sagun The Heritage Private School, Palodia, Limassol, Cyprus	**SP3** **BUILDING A BLACK HOLE BOMB** Varvara Muminova International School of Moscow, Russia	**WS2** **PRACTICAL APPLICATION OF LINEAR DIOPHANTINE EQUATIONS WITH TWO UNKNOWNS**	**WS5** **KAHOOT QUIZ**	**MP9** **MATHEMATICS IN DANCE** Ella Kolar, Paula Škrobar, Magdalena Zovko OS Braca Radic, Koprivnica, Croatia
10:15 – 10:30	**MP14** **NEURAL NETWORKS** Anna Mordvina International School of Moscow, Russia	**SP4** **DARK MATTER: WHY DOES IT MATTER?** Maria Tivanova The Heritage Private School, Palodia, Limassol, Cyprus	**WS3** (for grades 9-12 students) **ORNAMENTS: ALGEBRA MEETS GEOMETRY** Tomasz Szemberg Pedagogical University of Krakow	**WS6** (for students) **PARTICLE PHYSICS (elementary)** **PLAYING WITH THE QUARKS** Evangelos Gazis Institute of Accelerating Systems and Applications (IASA), Greece	**MP10** **MATHEMATICS IN ARCHITECTURE** Zana Sipek, Ella Vrabelj OS Braca Radic, Koprivnica, Croatia
10:30 – 10:45	**MP15** **Gaga's Golden Ratio** Celena Ota International School of Moscow, Russia	**SP21** **Left or Right Brain - Theory or Reality?** Ana Christina Johansson, Sophia Rosalinda Tammi Rygaards International School, Denmark	**WS3** **ORNAMENTS: ALGEBRA MEETS GEOMETRY**	**WS6** **PARTICLE PHYSICS (elementary)** **PLAYING WITH THE QUARKS**	**MP7** **MATHEMATICS IN MEDICINE** Martina Petrovic OS Braca Radic, Koprivnica, Croatia
10:45 - 11:00	**MP18** **INFINITE CHOCOLATE? YES, PLEASE!** Shengkun Zhao, Yufan Tang, Yawen Yang The Heritage Private School, Palodia, Limassol, Cyprus	**SP6** **GENETIC MUTATIONS: SUPERHEROS AND LACTOSE INTOLERANCE** Taisia Smirnyagina International School of Moscow, Russia	**WS3** **ORNAMENTS: ALGEBRA MEETS GEOMETRY**	**WS6** **PARTICLE PHYSICS (elementary)** **PLAYING WITH THE QUARKS**	**MP8** **MATHEMATICS IN HISTORY** Niko Sertić OS Braca Radic, Koprivnica, Croatia
11:00 - 11:15	**BREAK (water bottles with coupon from Marco Polo Bar)**				

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Coordinators	**Christina Papadopoulou** **Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Christos Kitsios**	**Dimitrios Tsintsilidas**	**Ioannis Iakovidis** **Athanasios Koutsopagos**
11:15 – 11.30	**MP3** **MATH IS IN THE AIR** Korana Grgac, Teo Hanzekovic OS Braca Radic, Koprivnica, Croatia	**MP53** **MATHLETICS** Andreas Hadjikallis, Eleni Papachristoforou, Anestis Louca, Maria Zorni, Thalia Theodorou American Academy Larnaca, Cyprus	**WS4** (for grade 6+ students and teachers) **ARE LINES STRAIGHT (FORWARD)?** Justyna Szpond Pedagogical University of Krakow	**WS8** (for students) **DENTAL MATH** Nikolina Kuzmić Šelimber and Hrvoje Šelimber Udruga mladih koprivničkih matematičara, Čarda 43, Koprivnica, Croatia Osnovna škola "Antun Nemčić Gostovinski" Koprivnica, Školska 5, Croatia	**SP7** **HOW DO WE LEARN?** Anastasia Vidyaeva International School of Moscow, Russia
11:30 – 11:45	**MP4** **MATHEMATICS AND ANIMALS** Elena Sijak, Nikolina Isabella Marija van Bregt OS Braca Radic, Koprivnica, Croatia	**MP31** **GRAPH THEORY PROBLEMS AND APPLICATIONS** Neven Lukić Gimnazija "Fran Galović" Koprivnica, Croatia	**WS4** **ARE LINES STRAIGHT (FORWARD)?**	**WS8** **DENTAL MATH**	**SP8** **THE FUTURE OF THE MICROCOSM** Yegor Kim, Pavel Burya, Konstantin Popov International School of Moscow, Russia
11:45 – 12:00	**MP5** **MATHEMATICS MODEL OF SUSTAINABLE TOURISM** Fran Filipović OS Braca Radic, Koprivnica, Croatia	**MP32** **FIBONACCI SEQUENCE IN NATURE** Karla Šmitlehner, Marta Šola Gimnazija "Fran Galović" Koprivnica, Croatia	**WS4** **ARE LINES STRAIGHT (FORWARD)?**	**WS8** **DENTAL MATH**	**SP9** **TRAVELLING IN SPACE, THROUGH SCIENCE** Napolina Yiannakou The Heritage Private School, Palodia, Limassol, Cyprus
12:00 – 12:15	**MP6** **MATHEMATICS IN SPACE** Luka Rubes OS Braca Radic, Koprivnica, Croatia	**MP71** **QUANTUM CRYPTOGRAPHY** Spanoudis Nikos De La Salle College, Thessaloniki, Greece	**WS1** **LET'S DISCOVER MATHEMATICS WITH DIGITAL TOOLS** Mara Grašić, Ksenija Varović Osnovna škola „Braća Radić", Koprivnica, Croatia Drnje, Croatia	**WS11** (for students) **HOW MANY DESCENDANTS?** Brendan McLoughlin International School of Moscow, Russia	**SP10** **ANTI-NUCLEAR MISSILE DEFENCE** Stepan Malov International School of Moscow, Russia

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Coordinators	**Christina Papadopoulou** **Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Christos Kitsios**	**Dimitrios Tsintsilidas**	**Ioannis Iakovidis** **Athanasios Koutsopagos**
12:15 – 12:30	**MP21** **MATHEMATICS IN GEOGRAPHY** Mihael Pjatakov, Marko Šarić, Cemal Ustundag Primary school "Braća Radić", Koprivnica, Croatia	**SP2** **BLACK HOLES AND HOW THEY ROTATE** Amira Sembieva International School of Moscow, Russia	**WS1** (for students) **LET'S DISCOVER MATHEMATICS WITH DIGITAL TOOLS**	**WS11** **HOW MANY DESCENDANTS?**	**MP54** **THE REAL THE IRRATIONAL AND THE IMAGINARY** George Karesiou, Marios Americanos, Panagiotis Grigoriou, Alexandros Zachariou American Academy Larnaca, Cyprus
12:30 – 12:45	**MP22** **CHECKMATE!** Matko Stanić Osnovna škola "Antun Nemčić Gostovinski" Koprivnica, Školska 5, Croatia	**SP5** **THE SECRETS OF THE SUBCONSCIOUS MIND** Lucia Hosein, Elizabeth Holt International School of Moscow, Russia	**WS1** **LET'S DISCOVER MATHEMATICS WITH DIGITAL TOOLS**	**WS11** **HOW MANY DESCENDANTS?**	**MP55** **MY TRIANGULAR WORLD** Galatea Evgeniou, Stephanie Demetriou, Marilia Fysentzidi, Charilia Papalambrou, Constatina Polycarpou American Academy Larnaca, Cyprus
12:45 – 13:00	**MP23** **MATHS AND MINECRAFT** Jakov Gregurić, Borna Sočev Osnovna škola "Antun Nemčić Gostovinski" Koprivnica, Školska 5, Croatia	**SP11** **THE FUSION REACTOR** Egor Kuzmichev International School of Moscow, Russia	**WS1** **LET'S DISCOVER MATHEMATICS WITH DIGITAL TOOLS**	**WS11** **HOW MANY DESCENDANTS?**	**MP56** **MATHEMATICS AND ARCHITECTURE** Erene Efstathiou, Stephanie Symeonidi, Kyriaki Paradisioti, Miranda Hadjimatheou, Maria Hadjichambi, Theodosia Hadjimarcou American Academy Larnaca, Cyprus
13:10 – 14:30	**Lunch Break, Place: GRAND BALL Rooms A &B (Level -2)** Coupons offered by TopKinisis Travel to those who booked accommodation through them. Additional coupons for sale available at the registration desk				

Thursday, 12 March 2020 Grand Hotel Palace, Thessaloniki, Greece					
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Coordinators	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Vasileios Makridis**	**Ioannis Iakovidis**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**
14:30 – 14:45	**SP12** **MAXIMUM POSSIBLE DEPTH THAT CAN BE REACHED DURING A FREEDIVE (NLT)** Alisa Polyakova International School of Moscow, Russia	**MP27** **MATHEMATICS IN BUILDING HOUSES** Izabela Lugarov, Matej Matijašić Osnovna škola Fran Koncelak, Pemija 72, Drnje, Croatia	**WS14** (for students) **USING MATHEMATICS TO SAVE WATER** Amélia C. Caldeira, Polytechnic of Porto, Porto, M. T. Malheiro, Rui M. S. Pereira, A. Manuela Gonçalves, S.O. Lopes, University of Minho, Braga, Portugal	**WS13** (for students) **AN EDUCATIONAL AND INCLUSIVE APPROACH OF GEOMETRY THROUGH FRACTALS** Anna Alfieri Liceo Scientifico "Luigi Siciliani" Catanzaro_Italy	**MP36** **THE PERFECT RACKET** Carmela Ciampi, Simone Di Dio, Chiara Iscaro, Laura Lanni, Antonio Pezzulo, Martina Varricchio Liceo Scientifico "G. Rummo" Benevento, Italy
14:45 – 15:00	**SP14** **CHERNOBYL AFTERMATH** Yuna Apryatina, Sofia Musakhanova International School of Moscow, Russia	**MP28** **A HISTORY OF THE METRE** Maia Kristina Arhall Bergendorff Rygaards International School, Denmark	**WS14** **USING MATHEMATICS TO SAVE WATER**	**WS13** **AN EDUCATIONAL AND INCLUSIVE APPROACH OF GEOMETRY THROUGH FRACTALS**	**MP33** **MUSIC AND MATHEMATICS** Klara Smiljanić Gimnazija "Fran Galović" Koprivnica, Croatia
15:00 – 15:15	**SP25** **PHYSICS OF FOOTBALL** Evgenios Evgeniou, Stathis Matolis, Michalis Mishelis American Academy Larnaca, Cyprus	**MP29** **TWO FACES NUMBERS** Ali Bulori Shahid Beheshti 1, Iran	**WS14** **USING MATHEMATICS TO SAVE WATER**	**WS13** **AN EDUCATIONAL AND INCLUSIVE APPROACH OF GEOMETRY THROUGH FRACTALS**	**MP34** **MATH IN FITNESS** Klara Šestak, Neven Lukic Gimnazija „Fran Galović" Koprivnica, Croatia

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Coordinators	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Vasileios Makridis**	**Ioannis Iakovidis**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**
15:15 – 15:30	**SP26** **GENES AT WORK, A BOARD GAME** Romano Raffaele, Amen Alessandro, Esposito Emanuele Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy	**MP30** **TRIPLE JUMP** Julian R. Trott, Tamás Kovács Rygaards International School, Denmark	**WS14** **USING MATHEMATICS TO SAVE WATER**	**WS12** (for students) **GENES AT WORK. A BOARD GAME TO WORK ON RELATIONSHIPS, ETHICAL SKILLS, STRATEGIC THINKING, PLANNING, COOPERATION, AND INCLUSIVENESS** Di Fonza Mario, Nappi Sabrina, Busiello Rosanna, Puzone Giuseppe, Settembre Vincenzo, Aiese Rosa Krizia, Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy	**MP37** **STUDYING MATHEMATICS AS A PIECE OF ITALIAN FOOD** Amoriello Pietro, Bovino Stefania, Iannella Alessia Liceo Scientifico "G. Rummo" Benevento, Italy
15:30 – 15.45	**SP18** **THE POWER OF THE MIND** Sara Švegović Gimnazija "Fran Galović" Koprivnica, Croatia	**MP19** **MATHEMATICS IN SOLAR SYSTEM** Tara Tetec, Leo Bradić Primary school "Braća Radić", Koprivnica, Croatia		**WS12** **GENES AT WORK. A BOARD GAME TO WORK ON RELATIONSHIPS, ETHICAL SKILLS, STRATEGIC THINKING, PLANNING, COOPERATION, AND INCLUSIVENESS**	**MP38** **SMARTPHONE AND MATHEMATICS** Giovanna Iannella, Alessandra Carla Coletta, Roberta Romano Liceo Scientifico "G. Rummo" Benevento, Italy
15:45 – 16:00				**WS12** **GENES AT WORK. A BOARD GAME TO WORK ON RELATIONSHIPS, ETHICAL SKILLS, STRATEGIC THINKING, PLANNING, COOPERATION, AND INCLUSIVENESS**	

Thursday, 12 March 2020 Grand Hotel Palace, Thessaloniki, Greece	
16:30 – 18:00	**Opening Ceremony** **EUROMATH and EUROSCIENCE 2020 Conference and ASTUCON 2020** **Room: Olympia B&C (Level 0)** **Invited Plenary** **"MATH IS FOR THE FUTURE" by** Mina Teicher, Emmy Noether Research Institute for Mathematics, Israel **(Read detailed programme in the booklet)**
18:00 – 19:00	**RECEPTION with traditional sweet of Thessaloniki** **Place: OLYMPIA (Level 0)**
	COMPETITION REHEARSALS
Coordinator	C. Papagiannis, S. Loizias, L. Makrides
19:00 – 20:30	(Reserve your wish for using the stage for rehearsal for the competitions below by sending an email to info@euromath.org (indicate name, school and competition) MATH and SCIENCE Theatre Europe Competition – Rehearsals **(Olympia B&C, Level 0)** MATHFactor Europe Competition – Rehearsals **(Patoulidou I , Level 0)** SCIENCE-Factor Europe Competition - Rehearsals **(Patoulidou II, Level 0)** Reserve your time slot, approximately 3 min per Factor, between 5-12 min per Theatre

EUROMATH & EUROSCIENCE 2020 – ASTUCON 2020 PROGRAMME

Friday, 13 March 2020 Grand Hotel Palace, Thessaloniki, Greece					
REGISTRATIONS (ROOM MULTIFUNCTIONAL CONFERENCE CENTRE: Arion Bar area): For Conference participants and Competition finalists					
Place	**Olympia B&C (Level 0)**	**Patoulidou A (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou B (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou**	**Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**
09:00 – 09:15	**SP28** **LIGHT, WAVE OR PARTICLE?** Hritik Roy Chowdhury Rygaards International School, Denmark	**MP39** **SADDLE UP!** Ciavanni Annachiara, Citarella Alessia, Lepore Liliana, Pellegrini Maria Helena Liceo Scientifico "G. Rummo" Benevento, Italy	**WS7** (for teachers and grade 11-12 students) **PARTICLE ACCELERATORS. THE MACHINES OF THE FUTURE** Evangelos Gazis Institute of Accelerating Systems and Applications (IASA), Greece	**WS10** (for grade 5-8 students) **THE UNIVERSE GOES TO PRIMARY SCHOOL** Elena Elliniadou MEd 2nd Primary School of Piraeus Uruguay, Greece	**MP70** **ANALYSIS OF THE GENERALIZED QUEEN PROBLEM** Ivan Ventsislavov Georgiev Sofia High School of Mathematics Sofia, Bulgaria
09:15 – 09:30	**SP29** **WEB RADIO LIVE** Alberto Pesce Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy	**MP40** **QUANTUM COMPUTERS** Antonio Pezzulo, Carlo di Pasquale, Chiara Iscaro, Giuseppe Viglione, Lorenzo Addivinola Liceo Scientifico "G. Rummo" Benevento, Italy	**WS7** **PARTICLE ACCELERATORS. THE MACHINES OF THE FUTURE**	**WS10** **THE UNIVERSE GOES TO PRIMARY SCHOOL**	**MP72** **MONTY HALL** Marko Praček St Stanislav Institution, Gymnasium, Ljubljana, Slovenia
09:30 – 9:45	**SP30** **IS LAB-GROWN MEAT SUITABLE FOR MASS CONSUMPTION?** Bakogiannis Eleftherios, Chatzakou Christine, Kakos Nickolaos, Nikolaou Konstantina, Tamvakas Chris The American College of Greece-Pierce, Athens, Greece	**MP41** **PROBABILITY OF FOOTBALL BETS** Giorgio Benedetto Bravi, Giovanni Catauro, Bruno Nesticò, Piofrancesco Rosella, Rinaldo Saviano Liceo Scientifico "G. Rummo" Benevento, Italy	**WS7** **PARTICLE ACCELERATORS. THE MACHINES OF THE FUTURE**	**WS10** **THE UNIVERSE GOES TO PRIMARY SCHOOL**	**MP49** **WHEN FOUR CURVES MEET** Panagiotis Bampatsias Varvakeio Model High School of Athens, Greece

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Coordinators	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou**	**Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**
09:45 – 10:00	**SP31** **CAR T-CELL IMMUNOTHERAPY: REVOLUTIONIZING CANCER TREATMENT** Ploumis Georgios, Sadopoulos Evaggelos Angelos, Tsikou Vasiliki Silvia The American College of Greece-Pierce, Athens, Greece	**MP42** **NETFLIX: AN ISSUE OF RECOMMENDATION!** Fiorentino Giuseppe Manuel, Fucci Francesca Pia, Paduano Francesco Agostino, Guerrera Concetta, Addivinola Lorenzo, Viscio Viglione Livia Liceo Scientifico "G. Rummo" Benevento, Italy	**WS9** (for students) **SOLVING PUZZLES AND RIDDLES USING LOGIC AND PROBABILITIES** Michalis Gavrielides The English School, Nicosia, Cyprus	**WS10** **THE UNIVERSE GOES TO PRIMARY SCHOOL**	**MP20** **MATHEMATICS ON GEOGRAPHICAL MAP** Jakov Koštarić, Damjan Koštarić Primary school "Braća Radić", Koprivnica, Croatia
10:00 – 10:15	**SP32** **THE NEW ERA OF ELECTRIC VEHICLES** Mistrioti Myrto, Tasouli Vasiliki, Karamouzi Vasileia, Bouris Eleni Ioannna, Mafoutsis Yasmine The American College of Greece-Pierce, Athens, Greece	**MP43** **LOVE AND MONEY** Giuseppe Abbate, Giuseppe Viglione, Mariagaia Miranda, Francesca Lacerra, Giorgia Iammarino,Carlo Di Pasquale Liceo Scientifico "G. Rummo" Benevento, Italy	**WS9** **SOLVING PUZZLES AND RIDDLES USING LOGIC AND PROBABILITIES**	**WS10** **THE UNIVERSE GOES TO PRIMARY SCHOOL**	**MP51** **1,2,3…N DIMENSIONS IN GEOMETRY** Emilia Biamonte, Martina Umbrello Liceo Scientifico "Luigi Siciliani" Catanzaro_Italy
10:15 – 10:30	**SP33** **LIGHT BULBS, LET'S SEE IT CLEARLY!** Esposito Emanuele, Romano Raffaele, Amen Alessandro Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy	**MP44** **LET'S GIVE IT A CUT** Boffa Maria Giulia, Fiorito Alessia, Giangregorio Luigi, Napolitano Swami, Verderosa Ciro, Verderosa Giuseppe Liceo Scientifico "G. Rummo" Benevento, Italy	**WS9** **SOLVING PUZZLES AND RIDDLES USING LOGIC AND PROBABILITIES**	**WS10** **THE UNIVERSE GOES TO PRIMARY SCHOOL**	**MP65** **ALAN TURING AND THE ENIGMA MACHINE** Belegrinos Eleftherios, Karaferis George-Paris, Tsormpatzoglou George The American College of Greece-Pierce, Greece

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Friday, 13 March 2020 Grand Hotel Palace, Thessaloniki, Greece					
Place	**Olympia B&C (Level 0)**	**Patoulidou A (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou B (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou**	**Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**
10:30 – 10:45	**SP34** **COPY AND PASTE…THE FUTURE?** Eleni Maria Vlotomas International School of Paphos, Paphos, Cyprus	**MP45** **INSTAGRAM: LET'S REVEAL ITS SECRETS!** Francesco Agostino Paduano, Laura Lanni, Martina Varriccchio, Maria Gaia Miranda Liceo Scientifico "G. Rummo" Benevento, Italy	**WS9** **SOLVING PUZZLES AND RIDDLES USING LOGIC AND PROBABILITIES**	**WS15** (for students) **MUSICMATH METHODOLOGY: FRACTIONS ENSEMBLE** Eric Roldan Roa, Erika Roldan Roa, Misael Hernández Leal, Aldo Martínez Chávez MusicMath team, University of Tartu, Zapopan-Jalisco-Mexico	**MP52** **TELL ME WHAT YOU EAT AND I WILL TELL YOU WHAT YOU ARE** Alberto Pesce Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy
10:45 – 11:00	**MP59** **NUMBER ART** Tea Hansson, Axel Palmé, Alva Strand Polhemskolan, Sweden	**SP35** **OUR VULNERABILITY TOWARDS OUR CYBER LIFE** Arian Adeli Koodehi International School of Paphos, Paphos, Cyprus	**WS16** (teachers and students) **BOOSTING CIRCULAR ECONOMY KNOWLEDGE IN STEM FUTURE CLASS** Eirini Siotou, Effie Papageorgiou, Lina Chachali Nea Genia Ziridis, Athens, Greece	**WS15** **MUSICMATH METHODOLOGY: FRACTIONS ENSEMBLE**	**MP66** **MATHEMATICS AND PHILOSOPHY** Juan A. Monge-Navarro Otero Turku International School, Finland
11:00 – 11:15	**MP60** **THE DEVELOPMENT OF CRYPTOLOGY** Astrid Hofwander, Engla Sundström Polhemskolan, Sweden	**SP36** **CELEBRITIES AND GLOBAL WARMING** Andreas Tavros International School of Paphos, Paphos, Cyprus	**WS16** **BOOSTING CIRCULAR ECONOMY KNOWLEDGE IN STEM FUTURE CLASS**	**WS15** **MUSICMATH METHODOLOGY: FRACTIONS ENSEMBLE**	**MP61** **EATING MATHEMATICS** Federica Petrella, Clara Verdino, Matteo Piscopo Liceo Scientifico "G. Rummo" Benevento, Italy

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Place	**Olympia B&C (Level 0)**	**Patoulidou A (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou B (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou**	**Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**
11:15 – 11:30	**MP24** **THAT TRICKY MATH** Noel Mađerić, Petar Šajfar Osnovna škola "Antun Nemčić Gostovinski" Koprivnica, Školska 5, Croatia	**SP37** **PROSTHETICS** Nersu Yahi Mediterranean High School, Larnaca, Cyprus	**WS16** **BOOSTING CIRCULAR ECONOMY KNOWLEDGE IN STEM FUTURE CLASS**	**SP22** **The Science Behind Emotions** Anwita Karanth, Lucia Alice Pitman Rygaards International School, Denmark	**MP62** **CONVERGENCE OF FUNCTIONS OF MARKOV CHAINS. APPLICATIONS IN DISCRETE STOCHASTIC MODELS** Martin Boyanov Stefanov Sofia High School of Mathematics, Yanko Zabunov Street, Sofia, Bulgaria
11:30 – 11:45	**MP25** **THE MUSIC OF MATHEMATICS** Ava Magdić, Nika Robotić Osnovna škola "Antun Nemčić Gostovinski" Koprivnica, Školska 5, Croatia	**SP38** **WHAT WILL HAPPEN IF EVERYONE IN THE WORLD WENT TO SLEEP AT THE SAME TIME AND WOKE UP AT THE SAME TIME?** Alex Kalaitsidis Mediterranean High School, Larnaca, Cyprus	**WS18** (for teachers) **EVERY WEEK... MATHS** Anita Grguric, Zlatka Miculinic Mance Prva rijecka hrvatska gimnazija, Frana Kurelca 1, Rijeka, Croatia	**SP23** **DARK ENERGY AND DARK MATTER** Areeb Sadath Jan Rygaards International School, Denmark	**MP64** **GAME THEORY** Marko Spyrou International School of Paphos, Paphos, Cyprus
12:10 – 12:30	**MP102** **APPLIED INTEGRATION: TAKING TOTAL IMPULSE OF THRUST-TIME CURVES FROM ACTUAL SOLID ROCKET MOTORS** Harry Amadeo King School, Stamford, CT 06905, USA	**SP39** **AUTISM SPECTRUM DISORDER** Maria Yiasoumi, Destine Akokcu Mediterranean High School, Larnaca, Cyprus	**WS18** **EVERY WEEK... MATHS**	**SP24** **ORBITAL MECHANICS OF THE MOTION OF PLANETS AROUND THE SUN** Rohit Roy Chowdhury Rygaards International School, Denmark	**MP63** **THE USE OF MATHEMATICS IN (AUTOMATED) TRADING** Arian Adeli Koodehi International School of Paphos, Paphos, Cyprus

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Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou**	**Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**
12:30 – 12:45	**MP57** **SOLVING CRIMES USING MATHEMATICS** Anastasia Demetriou, Danae Larcou, Eleni Apostolou American Academy Larnaca, Cyprus	**SP40** **TELEPORTATION: WHAT IS IT REALLY?** Anna Kalaitsidou Mediterranean High School, Larnaca, Cyprus	**WS18** **EVERY WEEK... MATHS**	**MP67** **TOPOLOGY AND KNOTS** Talemwa Nanyange Kyambadde Turku International School, Finland	**MP26** **THE TITANIC IN NUMBERS** Katja Gregurić, Eva Pintar Osnovna škola "Antun Nemčić Gostovinski" Koprivnica, Školska 5, Croatia
12:45 – 13:00	**MP58** **THE AESTHATIC OF MATH** Barbara Zachariou, Poline Haroutounian, Panagiota Mela American Academy Larnaca, Cyprus	**SP41** **DO YOU WISH YOU HAD A DOLPHIN'S BRAIN?** Elli Paphiti International School of Paphos, Paphos, Cyprus	WS21 INNOMATH (Erasmus+ programmme) as a catalyst for the STEAME approach Andreas Skotınos, Vice President of CMS	**MP68** **KNIGHTS AND KNAVES** Asen Evgeniev Tonkov, Hristo-Chocho Tsvetanov Vladovski, Deyan Tsvetelinov Minkov 125th SU "Boyan Penev", American College of Sofia, Bulgaria	**MP124** **THE ANATOMY OF COLOUR** Linnea Kärrman, Oskar Vågsäter Polhemskolan, Sweden
13:10 – 14:30	**Lunch Break, Place: GRAND BALL Rooms A &B (Level -2)** Coupons offered by TopKinisis Travel to those who booked accommodation through them. Additional coupons for sale available at the registration desk				

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Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Ioannis Iakovidis** **Athanasios Koutsopagos**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**
14:30 – 14:45	**SP42** **A STEM CELL DEBATE** Eleni Diogenous International School of Paphos, Paphos, Cyprus	**MP69** **VISIBILITY OF CONICS** Martin Dimitrov, Gergana Peeva, Borislav Stoyanov 125th SU "Boyan Penev", American College of Sofia, Bulgaria	**WS19** (for teachers) **MATH TRAILS WITH MATHCITYMAP** Amélia C. D. Caldeira, Ana Moura, Polytechnic of Porto, LEMA-ISEP, SYSTEC-ISR, Porto,Portugal	**MP74** **SUNFLOWERS** Eylul Nihat Mediterranean High School, Larnaca, Cyprus	**MP79** **A NOT SO SECRET TRIANGLE FULL OF SECRETS** Andreas Aloneftis, Theodoulos Ttelias, Sotiris Xiouros, Stephanos Zorpas The GC School of Careers, Nicosia, Cyprus
14:45 – 15:00	**SP43** **BEAUTY COMES FROM WITHIN** Salomi Perikleous, Tanya Vinogradova International School of Paphos, Paphos, Cypru	**MP46** **EVERYTHING IS NUMBER** Boffa Annachiara, Ferravante Sara, Fiorito Alessia, Napolitano Swami, Viscio Viglione Livia Liceo Scientifico "G. Rummo" Benevento, Italy	**WS19** **MATH TRAILS WITH MATHCITYMAP**	**MP75** **BUTTERFLY EFFECT** Tuna Ercika, Ioanna Gerolemou, Veronica Camanide, Amalia Chari Mediterranean High School, Larnaca, Cyprus	**MP80** **BEYOND THE BORDER** Rolandi Theodora, Yiallouri Panagiota, Yiorkadji Mary The GC School of Careers, Nicosia, Cyprus
15:00 – 15:15	**SP44** **FERMI PARADOX** Foteini Kioutsouki, Evangelos Neophytou The Grammar School, Nicosia, Cyprus	**MP47** **CANDY CRUSH'S PUZZLING MATHEMATICS** Francesca Pia Fucci, Concetta Guerrera, Francesca Lacerra, Carmela Ciampi, Maria Giulia Boffa, Liceo Scientifico "G. Rummo" Benevento, Italy	**WS19** **MATH TRAILS WITH MATHCITYMAP**	**MP76** **UNDERSTANDING COMPUTERS THROUGH OUR OWN VIDEO GAME** Leonidou Andreas, Theofanous Christos The GC School of Careers, Nicosia, Cyprus	**MP106** **QUICC MATHS: A GUIDE TO IGCSE REVISION** Marios Stavrou, Ioannis Papazacharias, Andreas Constandinides, Kyriakos Hadjimichael, Zacharias Ioannou, English School, Nicosia, Cyprus
15:15 – 15:30	**SP45** **SCHRÖDINGER'S CAT** George Rovanias The Grammar School, Nicosia, Cyprus	**MP48** **SWINGING MATH** Federica D'Agnese, Serena Pagano , Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy	**WS19** **MATH TRAILS WITH MATHCITYMAP**	**MP77** **MATHS IN YOUR FACE** Michalis Michaelides, Klitos Philippides, Christos Romanos The GC School of Careers, Nicosia, Cyprus	**MP82** **HOW NOT TO GET AWAY WITH MURDER** Bobrova Lisa, Pastella Josephina, Prodromou Carolina , The Senior School, Nicosia, Cyprus

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Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Kallipatira (Level +1)**
Coordinator	**Ioannis Iakovidis** **Athanasios Koutsopagos**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**
15:30 – 15:45	**SP46** **VIRTUAL REALITY** Theofanis Themistocleous, Nicole Charalambous, Davina Bentley, Marilena Constantinou American Academy Larnaca, Cyprus	**MP73** **COMPLEX & IMAGINARY NUMBERS** William Brander, Aatharva Kawade Rygaards International School, Denmark	**WS19** **MATH TRAILS WITH MATHCITYMAP**	**MP78** **A MATHEMATICAL BIOGRAPHY OF THE PRICE OF LIGHT** Nikolas Markoullis The GC School of Careers, Nicosia, Cyprus	**MP83** **TICKETS AND BOXES** Kaloyan Todorov Fachikov Sofia High School of Mathematics “Paisii Hilendarski” Sofia, Bulgaria
15:45 – 16:00	**SP47** **PRODUCING RENEWABLE FORM OF ENERGY FROM AGRICULTURAL BIOMASS** Kiril Ristevski, Gordana Todorova Yahya Kemal College, Skopje, North Macedonia	**SP52** **CLEANING UP OIL SPILLS WITH NANOTECHNOLOGY AND MAGNETS** Christina Rokana, Artemis Tsopanelis Geitonas School, Sternizes Koropiou, Athens, Greece	**WS20** (for students and teachers) **EU-MATHS-IN : MATHEMATICS AND INDUSTRY** Christophe Prud’homme, EU-MATHS-IN, AMIES, University of Strasbourg, France Andrés Prieto Aneiros, University of A Coruña, Spain	**MP88** **THE COMMON PROPERTY OF TRIANGLES 2-3-4 AND 3-4-5** Artur Kashnikov Tartu Annelinna Gymnasium Tartu, Estonia	**MP84** **THIRD DEGREE EQUATIONS** Afonso Domingues, Tomás Lôbo Campinos Lycée Français Charles Lepierre, Lisboa, Portugal
16:00 – 16:15	**SP48** **CONVERSION OF WASTE INTO NON-RETROGRADABLE ECO-FRIENDLY SOLUBILIZING AGENT** Rozafa Cana Yahya Kemal College, Skopje, North Macedonia	**SP54** **GENE THERAPY** Bampatsias Stergios, Pantazis Angelos Varvakeion Model Junior High School, Athens, Greece	**WS20** **EU-MATHS-IN : MATHEMATICS AND INDUSTRY**	**MP89** **AN INTRODUCTION TO COMBINATORICS** Konstantinidis Konstantinos, Papadopoulou Aikaterini, Tzartzi Petroula Mandoulides High Schools, Thessaloniki, Greece	**MP85** **A “BEAUTIFUL MIND” FOR THE CYPRUS PROBLEM** Cosma Emelia, Koulermos Isabella, Skordi Iliana The Senior School, Nicosia, Cyprus
16:15 – 16:30	**SP49** **MACHINE LEARNING AND ARTIFICIAL NEURAL NETWORKS** Haris Papadopoulos Delasalle High School, Thessaloniki, Greece	**SP59** **STRING THEORY- THE POSSIBLE THEORY OF EVERYTHING** Melina Bell Geitonas School, Sternizes Koropiou, Athens, Greece	**WS20** **EU-MATHS-IN : MATHEMATICS AND INDUSTRY**	**MP90** **MATHEMATICS AND NATURAL SELECTION** Markou Anna, Christou Panos, Christou Adamos he Archbishop Makarios III Lyceum, Ktima, Paphos, Cyprus	**MP86** **MATHEMATICS IN SPORTS** Felous Filippos, Sapounaki Stella, Stamou Athanasios-Nikolaos, Tsagiannis Georgios The American College of Greece-Pierce, Greece

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Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Klalipatira (Level +1)**
Coordinator	**Ioannis Iakovidis** **Athanasios Koutsopagos**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**
16:30 – 16:45	**SP50** **MODERATE DEATH** Konstantina Efstathiadou, Koralia Karapataki, Chrysovalandia Menicou, Anna Orthodoxou American Academy Larnaca, Cyprus	**SP60** **WIM HOF METHOD** Jošt Lombardo St Stanislav Institution, Gymnasium, Ljubljana, Slovenia	**SP76** **BACTIRIOPHAGES** Dasia Razumova The Senior School, Nicosia, Cyprus	**MP91** **ETHNOMATHEMATICS** Panagiota Papakyriakou The Grammar School, Nicosia, Cyprus	**MP87** **HOW TO WIN AT SUDOKU** Kalleas Spyros, Katsareas Ilias, Mavrias Konstantinos, Peppes George, Politis Sotiris The American College of Greece-Pierce, Greece
16:45 – 17:00	**SP55** **TRAVELLING WITH TIDES** Giorgos Alexandrou, Marcos Phinikarides The GC School of Careers, Nicosia, Cyprus		**SP27** **YES, CELLS COUNT** Federica D'Agnese, Serena Pagano Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy		**MP92** **FIBONACCI SEQUENCE** Constantinos-Laertis Andrianos The Grammar School, Nicosia, Cyprus
17:00 – 17:15	**SP56** **TO EAT OR NOT TO EAT** Erato Markantoni, Gregoria Samouti The GC School of Careers, Nicosia, Cyprus		**SP77** **LIFE AND WORK OF ISAAC NEWTON** Zenonos Andreas, Ellinas Pavlos Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus		**MP93** **MATHEMATICS BEHIND THE GREAT PYRAMID** Christiana Katsarou, Eloise Charalambous, Eva Assiotou The Grammar School, Nicosia, Cyprus
17:15 – 17:30	**SP57** **THE SCIENCE BEHIND SUPERHEROES** Georgios Karagiannis, Petros Kyriacou, Stylianos Lois, Stylianos Tamasios The GC School of Careers, Nicosia, Cyprus		**SP61** **IDENTIFICATION OF MECHANISMS AND FEATURES OF COLOR FORMATION BASED ON THE MEASUREMENT OF THE TRANSMISSION SPECTRUM OF DYES IN WATER SOLUTIONS** Maksim Turovski Tartu Annelinna Gymnasium, Tartu, Estonia		**MP94** **USING MATHS TO SOLVE RUBIK'S CUBE** Iosif Elia The Grammar School, Nicosia, Cyprus

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Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Klalipatira (Level +1)**
Coordinator	**Ioannis Iakovidis** **Athanasios Koutsopagos**	**Christos Kitsios** **Vasileios Makridis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**
17:30 – 17:45	**SP58** **THE POWER OF THE SUBCONSCIOUS MIND** Carolina Hadjidemetriou, Dimitris Kassianides The GC School of Careers, Nicosia, Cyprus		**SP62** **INVASTIGATION OF THE RELATIONSHIP BETWEEN THE COLOR OF AN INCADESCENT LAMP, THE EMISSION SPECTRUM AND THE FILAMENT'S TEMPERATURE. OR ELSE, WHAT IS THE SURFACE TEMPERATURE OF A STAR?** Miltiadis Raptis, Agrippina Margaritou Geitonas School, Sternizes Koropiou, Athens, Greece		**MP95** **BENFORD'S LAW AND ITS ECONOMIC APPLICATIONS** Elisavet Aifanti Varvakeio Model High School of Athens, Greece
17:45 – 18:00					**MP96** **DAY IN, DAY OUT** Andrej Bozic, Luka Kirincic, Luka Zmak Prva rijecka hrvatska gimnazija, Frana Kurelca 1, Rijeka, Croatia
18:00 – 18:15					**MP97** **MATHEMATICS IN BOHEMIAN RHAPSODY** Lucijan Mofardin Prva rijecka hrvatska gimnazija, Frana Kurelca 1, Rijeka, Croatia
18:15 – 18:30					**MP98** **MATHS AND CRIMINOLOGY** Kristia Kouppi, Athina Panayidou, Constantina Stefani, Eliana Gabrielides, Nguyen Ly Thuy Linh, Antigoni Ioannides, Ellie Mountoukou Pascal English School, Lemesos, Cyprus

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Place	**Room: Patoulidou I, Patoulidou II**	
CoordinatorS	**C. Papagiannis, S. Loizias, T. Evagorou, P. Faklamas**	
17:00 – 19:30	**MATHFactor and SCIENCEFactor Europe 2020 Competitions – Finals** **Open to the public**	
	Finals MATHFactor Europe 2020 **Room Patoulidou I (Level 0)**	**Finals SCIENCEFactor Europe 2020** **Room Patoulidou II (Level 0)**
17:00 – 19:30	**MATH-FACTOR EUROPE 9-13** MFL1, MFL2, MFL3, Mfl4, MFL5, MFL6, MFL7, MFL8, MFL9, MFL10, MFL11, MFL12, MFL13, MFL14, MFL15, MFL16, MFL17 **SCIENCE-FACTOR EUROPE 9-18** SF1, SF2, SF3, SF4, SF5, SF6, SF7, SF8, SF9, SF10, SF11, SF12, SF13, SF14, SF15	**MATH-FACTOR EUROPE 14-18** MFU1, MFU2, MFU3, MFU4, MFU5, MFU6, MFU7, MFU8, MFU9, MFU10, MFU11, MFU12, MFU13, MFU14, MFU15, MFU16, MFU17, MFU18, MFU19, MFU20, MFU21, MFU22, MFU23, MFU24, MFU25
20:30 – 01:00	**Dinner Dance "*Mathematics and Science by Night*" …. and π Birthday Cake** **Place: Olympia A , B, C (Level 0)** **Address: Grand Hotel Palace**	

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Saturday, 14 March 2020 Grand Hotel Palace, Thessaloniki, Greece					
	π COMPETITIONS				
09:00 - 10:00	European STEAME Communication Competitions for adults (online) (09:00 – 09:30 Room Seros, Level 0)		European Mathematics Journalistic Article Competition "Mathematics is Everywhere" (09:30 – 10:00 Room Kallipatira, Level +1) MJAC1, MJAC2, MJAC3, MJAC4, MJAC5, MJAC6		
Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Ioannis Iakovidis** **Athanasios Koutsopagos**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Christos Kitsios** **Vasileios Makridis**
09:30 – 09:45	**MP118** **CRACKING A LOCK USING MATHS** Natalia Eleftheriou, Despina Vasiliou, The Senior School, Nicosia, Cyprus	**MP110** **THE MAGIC BEHIND THE NUMBER e** Konstantinos Koutoulidis, Foivos Milovanovic, Emmanuel Venios Moraitis School, Athens, Greece			
09:45 – 10:00	**MP119** **HEXAPAWN – A GAME THAT LEARNS** Eva Deftera, Sotiris Efstathiou The Senior School, Nicosia, Cyprus	**MP109** **THE EULER LINE** Daeira Naskari, Katerina Kyriakidi, Natalia Triantafyllou, Elena Alevropoulou, The Moraitis School, Athens, Greece			
10:00 – 10:15	**MP120** **WHAT MAKES US SPEND MORE IN SUPERMARKETS, AND FEEL GOOD WHILE DOING IT** Mehmet Derin Ozser The Senior School, Nicosia, Cyprus	**MP111** **COMPLEX NUMBERS AND THEIR IMPORTANCE IN EULER'S IDENTITY** Natalia Kokoromiti, Giorgos Kosmas, Stergios Birbilopoulos, Ariadni Pilioura The Moraitis School, Athens, Greece	**SP63** **ELUCIDATING THE MYSTERY OF STARS AND BLACK HOLES** Maria Nicolaides, Kosmas T. Papadopoulos American Academy Larnaca, Cyprus		**SP67** **ENO-CARPOLOGICAL STUDY OF GEORGIAN VINE SPECIES PROTECTED IN GEORGIA AND EVALUATION OF THEIR ANTIOXIDANT PROPERTIES** Luka Kuchukhidze, Maria Lomaia, Elisabed Martiashvili, Lizi Kuprashvili Tbilisi International School, Georgia

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Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Ioannis Iakovidis** **Athanasios Koutsopagos**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Christos Kitsios** **Vasileios Makridis**
10:15 – 10:30	**MP121** **INFINITY CAN VARY** Dasia Razumova The Senior School, Nicosia, Cyprus	**MP105** **TREE (3)** Elias Vadebo, Anton Lundqvist Polhemskolan, Sweden	**SP64** **DOES TIME EXIST?** Tatiana Pelecanou, Demetra Efstathiou, Mary Efstathiadou, Despina Michaelidou American Academy Larnaca, Cyprus		**SP68** **THE ROBOTS KINGDOM IS NEAR** Dimitris Papamiltiades, Nicky Hadjigeorgiou, Antriana Kranidioti, Giannis Marmaras Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus
10:30 – 10:45	**MP99** **MATHEMATICS BEHIND THE IN ASPENDOS ANCIENT THEATRE ARCHITECTURE** Ensar Abdullah Demirbilek, Talha Yunus Demirbilek Ülkü Ortaokulu, Isparta Turkey	**MP114** **WHAT YOU'LL FIND IN HIGHER DIMENSIONS** Tiana Taliotou, KiriakI Hadjipanayiotou, Anna Maria Hadjipanayiotou, Andreas Hadjitofis, Solwnas Konstantinou The Archbishop Makarios III Lyceum, Paphos, Cyprus	**SP65** **SPACE EXPLORATION** Tarek Abd El-Aziz Yahya Kemal College, Skopje, North Macedonia	**WS17 (for students by pre-registration)** **MATH-Triathlon** Kostis Andriopoulos, The Moraitis School, Athens, Greece Nikos Papadopoulos, The Senior School, Nicosia, Cyprus	**SP70** **PLASTIC POLLUTION: WHAT IS NEXT?** Alberto Mparkis, Sotiris Panagakis, Christina Papaefthimiou, Marios Pantazopoulos Nea Genia Ziridis, Athens, Greece
10:45 – 11:00	**MP103** **THE LOGIC BEHIND QUATERNIONS** Konstantinos Leontiadis, Odisseas Nikolaos Mpalis Varvakeio Model High School of Athens, Greece	**SP72** **TIME IS RELEVANT OR ISN'T IT?** Elena Mantzouka Nea Genia Ziridis, Athens, Greece	**SP66** **SPACE AND PLANETS** Melina Iacovou, Loukia Stavrou American Academy Larnaca, Cyprus	**WS17** **MATH-Triathlon**	**SP75** **HOW TO YOU FUND YOUR GENES?** Arian Adeli Koodehi International School of Paphos, Paphos, Cyprus

EUROMATH & EUROSCIENCE 2020 – ASTUCON 2020 PROGRAMME

Saturday, 14 March 2020 Grand Hotel Palace, Thessaloniki, Greece					
Place	**Olympia B&C (Level 0)**	**Patoulidou I (Level 0)**	**Olympiad A (Level 0)**	**Patoulidou II (Level 0)**	**Kallipatira (Level +1)**
Coordinators	**Ioannis Iakovidis** **Athanasios Koutsopagos**	**Athanasios Kouroupis** **Grigoris Kopsacheilis**	**Dimitrios Tsintsilidas** **Dimitrios Konstantinidis**	**Christina Papadopoulou** **Grigoria Iosifidou**	**Christos Kitsios** **Vasileios Makridis**
11:00 – 11:15	**MP100** **INFINITY** Enzo Caldas, Martim Carvalho, Guilherme Terça Lycée Français Charles Lepierre, Lisboa, Portugal	**SP71** **GYROSCOPIC ROTATION** Kyriakos Dodson, Oliver Williams, Joshua Bryans, Parisinos Cavaye International School of Paphos, Paphos, Cyprus	**MP112** **CRYPTOGRAPHY USING MATHS** Joseph Modestos Modestou International School of Paphos, Paphos, Cyprus	**WS17** **MATH-Triathlon**	**SP83** **FOOTBALL MATHEMATICS AND PHYSICS** Bruna Plese Prva rijecka hrvatska gimnazija, Frana Kurelca 1, Rijeka, Croatia
11:15 – 11:30	**MP104** **DECODING MATHEMATICAL PATTERNS IN PLANTS** Talha Yunus Demirbilek, Ensar Abdullah Demirbilek Ülkü Ortaokulu, Isparta Turkey	**SP73** **ROBOTS TAKE CONTROL** Danai Fragki Nea Genia Ziridis, Athens, Greece	**MP115** **CLIMATE CHANGE CONTROL THROUGH GAME THEORY** Economou Kyriaki, Kyriacou Semeli, Christodoulou Eleftheria Lyceum A' Ethnarchis Makarios III Pafos, Cyprus	**WS17** **MATH-Triathlon**	**SP79** **THE WEIRDEST PYSICAL PHENOMENA** Marilena Alexandrou, Anna Andreou, Kyriaki Neofytou, Artemis Katsonouri, Natalia Constantinou Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus
11:30 – 11:45	**MP107** **HISTORY OF MATH** Rosa Gustavo, Goual Adam Lycée Français Charles Lepierre, Lisboa, Portugal	**SP80** **A MATHS PILL** Amoriello Pietro, Bovino Stefania , Iannella Alessia Liceo Scientifico "G. Rummo" Benevento, Italy	**MP122** **MATH IN OUR LIFE** Vasilis Papaioannou IE' Agios Neophytos School-Kato Polemidia, Lemesos, Cyprus	**WS17** **MATH-Triathlon**	**SP82** **THE BOTTLE FLIP** Shana-Maria Gossoub, Dariia Khudobiak, Ceren Semiye, Noa Alessia Phil, Naomi Gonzaga Gerber, Olga Georgiou, Caelan Jackson Byrne Grade 6 Med Junior School, Larnaca, Cyprus

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11:45 – 12:00	**MP108** **THE MATHS OF SPORTS OR AT LEAST OF SPORT BETTINGS** Botond Fehér Turku International School, Finland	**SP78** **THE WORLD THROUGH THE EYES OF AN ANIMAL** Anna Panagiotou Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus	**MP123** **PYTHAGORAS** Alexandros Papageorgiou, Polydoros Sotiriou Lyceum A' Ethnarchis Makarios III Pafos, Cyprus	**WS17** **MATH-Triathlon**	
12:00 – 12:15	**MP81** **WOMEN COUNT: TIME FOR CHANGE** Marion Kokkinou Kykkos A Lyceum, Nicosia, Cyprus	**SP81** **STARS, EMBRYOS, AND THE UNITING POWER OF ALGORITHMS** Janat Derawi, Noor Farid Mediterranean High School, Larnaca, Cyprus	**MP113** **PROBABILITY** Dina Novikova, Jessica Vikersjo, Daria Kyrylova, Olga Machowska International School of Paphos, Paphos, Cyprus	**WS17** **MATH-Triathlon**	
12:15 – 12:30	**MP117** **DESIGN AND CONSTRUCTION OF 3D PRINTER** Romanos Gkougkoulias Supervisors: Lina Chachali, Eirini Siotou Nea Genia Ziridis, Athens, Greece	**SP74** **RENEWABLE RESOURCES OR PLANET DISASTER?** Georgios Chrysou, Daniela Felouri Nea Genia Ziridis, Athens, Greece	**MP116** **ETHNOMATHEMATICS** Ismini Anagnostou, Stella Dimitriou, Danai Fragki, Sophia Gkourogianni, Alexia Zafeiriou Nea Genia Ziridis, Athens, Greece	**WS17** **MATH-Triathlon**	

EUROMATH & EUROSCIENCE 2020 – ASTUCON 2020 PROGRAMME

Saturday, 14 March 2020 Grand Hotel Palace, Thessaloniki, Greece					
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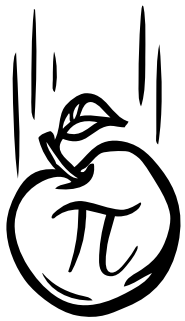
12:30 – 12:45	**MP125** **MATH DETECTIVE** Alexander Angeli, Giorgia Guarnieri, Dino Marinelli, Valentina Mocatti, Elena Pangrazzi, Giulia Parma Zappini, Anastasia Timis, Maria Chiara Vicentini, Marzia Zanon Istituto Comprensivo Di Scuola Primaria e Secondaria Bassa Val Di Sole, Italy	**SP85** **STOMACH ULCER** Eftychios Malialis, Michalis Panagiotou, Yiangos Michael, Petros Petrou, Prodromos Xrisostomou Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus		**WS17** **MATH-Triathlon**	
12:45 – 13:00				**WS17** **MATH-Triathlon**	
13:00 – 14:15	**Lunch Break, Place: GRAND BALL Rooms A &B (Level -2)** Coupons offered by TopKinisis Travel to those who booked accommodation through them. Additional coupons for sale available at the registration desk				

Saturday, 14 March 2020 Grand Hotel Palace, Thessaloniki, Greece		
	MATH & SCIENCE Theatre Europe 2020 Competition – Finals (Olympia A&B) Open to the public	
Coordinators	C. Papagiannis, S. Loizias, T. Evagorou, P. Faklamas	
14:30 – 16:30	**MATH-SCIENCE THEATRE (Olympiad A&B , Level 0)** MST1 , MST2 , MST3 , MST4 , MST5 , MST6, MST7, MST8	
16:30 – 17:00	Celebration of the day of π – Activity in front of the entrance of the hotel (all students and their teachers) –be there WITH YOUR π HATS	
17:00 – 17:30	**JUICE BREAK (Olympia A, B, C)**	
	AWARDS CEREMONY (Olympia A, B & C, Level 0)	
Coordinator	C. Papagiannis, S. Loizias, T. Evagorou, P. Faklamas, A. Charalambous, L. Makrides, G. Alexadrou	
17:30 – 19:00	Results of MATH & SCIENCE Poster Design 2020 Competition Results of MATH & SCIENCE Theatre Europe 2020 Results of MATHFactor Europe 2020 Results of SCIENCEFactor Europe 2020 Results of MATHPresentation 2020 Competition Results SCIENCEPresentation 2020 Competition Results of European Mathematics Journalistic Article Competition Results of European STEAME Communication Competition for adults Results for MATH-Triathlon Competition Results of most active student participation in EUROMATH & EUROSCIENCE 2020 Other awards	
Sunday, 15 March 2020		
All day	**Departures**	



ABSTRACTS BOOKLET

Contents

KEY NOTE SPEAKER

MATH IS FOR THE FUTURE

Mina Teicher
Emmy Noether Research Institute for Mathematics, Israel

ABSTRACT

Mathematics is present in future technological and societal fields of life in a way that you don't expect: without mathematics there will be no cyber security, without mathematics there will be no artificial intelligence nor robotics, without mathematics there is no reaching to the outer space, without mathematics there will be no smartcities, and with out mathematics there is no modern healthcare , no personalized medicine, no cure for neurological disorders, no vaccine for epidemic's, no artificial organs and no genetic cure for birth defects.

The talk will present the challenges of communicating mathematics and present few suggestions on the importance of mathematics for society and the beauty of mathematics. Some startups that use mathematics will also be presented.

STUDENT PRESENTATIONS IN MATHEMATICS

MP1. DIABETES IS MATHEMATICS

Marija Švegović
Centar Izvrsnosti, Koprivnica, Croatia

Diabetes is one of the most common diseases of today. New cases of diabetes are diagnosed in the world every three seconds, and every six seconds one person dies from the consequences of diabetes.
There are about 400 million people in the world who suffer from diabetes, and it is expected that there will be 592 million affected people by the year 2035. If diabetes is recognized on time and treated, complications can be prevented, or at the very least delayed.
How are diabetes and Mathematics connected?
I'll walk you through diabetes in a mathematical way, treating diabetes with insulin, blood glucose measurement, ideal weight and much more. For example, how many calories and sugar we need to get into our body to have normal blood glucose level, the importance of measurement of blood sugar concentration, explain two fundamental types, talk about proper nutrition and introduce some of the symptoms, all with the help of mathematics.

MP2. MATH IN VUČEDOL CULTURE

Lea Smiljanec, Nera Tomrlin
Centar Izvrsnosti, Koprivnica, Croatia

5000 years ago, Troja was in development, pyramids were being constructed in Egypt, the Sumerians were inventing the cuneiform and the first European calendar. Stonehenge isn't even being tought of. At the same time, a very advanced culture was emerging in Croatia.
Vučedol culture is the European response to the high civilization of the Orient. Vučedol itself is very unique. They had the first pictorial script in this part of Europe, established the first Indo-European calendar with 365 days in a year, produced the first bronze alloy, had a measure of length and weight, as well as revolutionized metallurgy with the mass production of metals. The way they lived tells us they had high standards.
In Vučedol society there were rituals that related to astronomical events and shrines which were built according to certain mathematical rules. Their knowledge of mathematics and astronomy led them to creation of the first Indo-European calendar. They marked their knowledge in ceramics. The most common motive was chess boards that, were used for multiplication table, as well as for calendars.
Understanding of the calendars and drawing the chessboards speaks of their logical understanding of the future Pythagoras` theorem.
The symbol of both Vučedol and Croatia is the Vučedol dove. Vučedol is a place where Europeans can come to pay respects to their origins, their first calendar, metallurgy and much more.

MP3. MATH IS IN THE AIR

Korana Grgac, Teo Hanzekovic
OS Braca Radic, Koprivnica, Croatia

In this presentation we will talk about various ways how numbers are used in air traffic. We will research the meaning of numbers at the airport during orientation in an airport building before a flight and explain the importance of numbers in calculating the amount of necessary fuel, luggage weight, the number of passengers and the importance of numbers in some features on the pilot's control board. We will describe how the language of numbers can facilitate the communication between the airport and its passengers as well as the control tower and the pilot, who uses numbers to manage devices on the control board. Our talk will also present the information about the level of noise produced by planes and about other situations in which we find numbers in air traffic. Moreover, this presentation will clarify how mathematics can help us understand why planes do not fly along an imaginary straight line and what would happen if they did. We will connect numbers on a map (GPS locations, distance between cities) with an airplane flight trajectory curve and explain why air distance numbers cannot be the same as the numbers used for road traffic distances. Using the above mentioned terminology, we will show the connection of mathematics, geography and physics as well as their real-life applications in traffic.

MP4. MATHEMATICS AND ANIMALS

Elena Sijak, Nikolina Isabella Marija van Bregt
OS Braca Radic, Koprivnica, Croatia

Mathematics is everywhere around us. Everything you see involves mathematics; the things, the people, and the animals.
If we take a look at the animals, we can see a lot of difference in shape, speed, structure and colour. Every particular specie has its own unique characteristics. We are going to show you the correlation between the DNA of animals, their colour and/or spot patterns.
Alan Turing came up with a simple set of mathematical rules that could give us rise to all manners of patterns. The rules go something like this: inside each theoretical organism there are two substances called an activator and an inhibitor. The activator stimulates production of both substances, while the inhibitor slows production down.
Mathematics makes our lives easier and we need to learn mathematics to understand the lives of animals better.

MP5. MATHEMATICS MODEL OF SUSTAINABLE TOURISM

Fran Filipović
OS Braca Radic, Koprivnica, Croatia

I live in small country Croatia in region Podravina which is adorned by river Drava with rich valley in the midle and small hills on the other side. Diverse history, lots of food and vineyards is what makes Podravina adorable and recognizable. In one hand, rich gastronomic offers, lots of culture sites and events, and on the other hand lack of accommodated capacity. And that's where mathematical problems start, that's where there's lots of calculating and ideas, some useful some useless. Without maths we would be uncertain without true arguments and of course, because of that, we have no solution. Calculations show us classic type of hotel's capacities. And then they shows us the idea of natural, ecologically acceptable materials with which we can build accomodation entities with small sum of money.
Why is that type of building more acceptable and profitable?
Beacuse these are domestic materials like bricks, wood, tile, straw made by local craftsmen. Also because of traditional style of building.
Price of that type of building is the real mathematical challange. That's the easy argument for investors and banks or bankers. Apartments and cottages can be placed near lakes, which we have plethora of, hills, and magical valley with field full of wheat. That landscape has many bicycling paths, galleries, museums…

MP6. MATHEMATICS IN SPACE

Luka Rubes
OS Braca Radic, Koprivnica, Croatia

Mathematics is all around us, but often we don't notice it because most of the time we look at the world and our life with our own eyes rather than thinking mathematically.
For example, in the universe we can find a lot of mathematical puzzles and different thinking examples of mathematicians dealing with space. But to not just talk about space, on Earth there are different mathematical forms, like a golden ratio, which is very interesting and we can find it in a cactus or in the appearance of a snail's house.
We also have various scientists in the mathematical field, such as Galileo, who said that the universe was a "great book" written in mathematical language. Back in 1916., Albert Einstein calculated, based on his theory of relativity, that the universe should expand, but did not believe his own results and missed the opportunity to announce one of the most important scientific predictions. 13 years after Einstein's discovery, Edwin Hubble found clear evidence that the universe indeed is expanding.
In the universe, we have different concepts such as sphere, and they even have their own set of formulas. The biggest mathematical mystery is the Sun, which is needed for the life of humans and plants. The solar system itself is built according to mathematical laws, ring-shaped or in the form of an ellipse.

MP7. MATHEMATICS IN MEDICINE

Martina Petrovic
OS Braca Radic, Koprivnica, Croatia

Mathematics is present all around us, and so is medicine, or the treatment of diseases. Mathematical calculations are used to determine the diagnosis of one's illness and then the treatment. Medicine is a branch of human activity that is divided into human medicine, animals (veterinary medicine) and plants (phytomedicine). At the first examination of a patient, the doctor first notices the symptoms of the disease and hypothesizes a disease. By measuring temperature and other findings, numerical values are obtained and according to them an accurate diagnosis is made. Based on the numerical values of certain parameters, accurate diagnosis can be made, and thus therapy can be determined. Therefore, mathematical calculations play a key role in making the right diagnosis, determining therapy, and ultimately healing the patient. As someone who has great ambition for medicine, I will show you how to connect these two natural sciences that cannot do without each other.

MP8. MATHEMATICS IN HISTORY

Niko Sertić
OS Braca Radic, Koprivnica, Croatia

When, how and in which order where the numbers created? How did people in the past count? When did they start to write down numbers? How did they call them? These are all the questions that you cannot easily answer. One thing is sure: people didn't always know how to count in the way that we do today.
The development of mathematics is inseparably linked to the general development of human society. Millenniums have passed in the pre–civilization era, until the concept of numbers began to form in human consciousness. A lot of time has passed before a man who was gathering fruits begun to hunt, raise cattle and cultivate the land. By doing such tasks he was able to tell the difference between the number of fruits picked and animals hunted. A person from the pre–civilization era was able to identify the elements in a set. This enabled him to assess the size of his herd and to see if he is missing any sheep.
In my presentation I am going to show you how numbers and people with them evolved in the past, and how mathematics has helped them do that.

MP9. MATHEMATICS IN DANCE

Paula Škrobar, Magdalena Zovko
OS Braca Radic, Koprivnica, Croatia

Mathematics has an important role in all aspects of our lives. We found it in dance! In every dance move we can find math – diagonal, degrees, fractions, geometric, shapes, dimensions… All these are mathematical elements which we can find in dance. For example, the cha-cha-cha has many diagonals, body needs to be upright, shoulders and feet need to be diagonal to each other and in the dance moves legs need to be vertical, 90°. To make dance move, jump, we use degrees and fractions. We can turn around us for 360°, 180°, 90° or we can use fractions and turn around for ½, ¾, 1/3.
One of dance move is pirouette and to perform it we need to turn around 360°. So, as you can see math can be found in every dance step… let us show you!

MP10. MATHEMATICS IN ARCHITECTURE

Zana Sipek, Ella Vrabelj
OS Braca Radic, Koprivnica, Croatia

In today's world we are surrounded by many buildings. All of them are a part of modern or old architecture. Architecture is the art and science of design of structures or buildings such as houses, monuments and office buildings.
There are different styles of architecture in Croatia, such as pre-Romanesque, Romanesque, Gothic and Renaissance. There are many types of architecture, the likes of Islamic architecture, Greek architecture, Roman architecture, Egyptian architecture…
Measurements such as meters, centimeters, decimeters, kilos, angles, are mandatory in process of drawing buildings, houses, skyscrapers…
Static physics is a science of balance and it is very important in architecture process of development of buildings. It is not just putting plain surfaces on paper but a lot of mathematical calculations hidden behind pretty walls of a building.
Due to that, each building is unique on its own way and has it is own story….

MP12. NAVIGATING THE WORLD

Innokentiy Kaurov
International School of Moscow, Russia

Every day, many people try to measure their locations. Prior to our generation, people were commonly using compasses and paper maps, which were all drawn by hand and were not always accurate. Today, we use satellites, GPS and many other devices and tools that can even be downloaded onto our phones, with a remarkable degree of accuracy. However, when was the last time you asked yourself “How do these devices work?” or “If I was to create a type of identifier for location, what would it look like?”.
Nowadays, every phone has some kind of navigation system of application. Many people know that data is transferred from satellites to mobile phones through waves that our phones can then decode and show to the user. However, have you ever thought about how the information is converted to the waves so it can eventually reach the Earth? The satellites of course do not only transmit the data for the GPS in our phones: the worldwide uses of satellites include weather forecasting, building 3D maps of the world and even communication through space! As the uses of satellites get more and more complex, it becomes absolutely astonishing how precise and wise the technologies of the satellites are.
This presentation will discuss in detail how satellites are used for navigation and other important purposes, and their processes of transmitting information from thousands of kilometres above to the surface.

MP14. NEURAL NETWORKS

Anna Mordvina
International School of Moscow, Russia

The visual world seems naturally effortless for us humans to understand. Over many centuries evolution has developed our minds so that we can now readily recognise images, patterns and faces of those around us in everyday life; in fact, the process of image recognition is so simple for us, that it seems we could easily teach computers to do the same. But if we try to formalise this process by means of conditional algorithms, it ends up being mission impossible.
Therefore, in areas of computer vision where formalisation would be very difficult, instead of providing explicit instructions, models such as Artificial Neural Networks (ANN) are used. Through these machine learning algorithms, computers of essentially no prior knowledge would be able to learn how to recognise different types of images based merely on sets of training data. The structure of neural networks is vaguely inspired by those of our own brains. But we don’t have an accurate understanding of the brain’s functions, so processes through which machines learn may likewise seem a mystery to us.
In this presentation I will explain the mathematical model behind the ANN - the structure of the network, the ‘loss function’ and the process of backpropagation. I will also demonstrate a sample neural network, and how specific changes in the initial parameters, loss function and training data can affect the speed and effectiveness with which the machine learns. Finally, the presentation will explore difficulties in using ANN for computer vision and how those issues are resolved.

MP15. GAGA'S GOLDEN RATIO

Celena Ota
International School of Moscow, Russia

The Golden Ratio is probably most famous for being used in visual arts. However, many people do not recognize that it is commonly used in the world of music too.
A familiar example of a golden ratio is found on the scale of the piano. An octave of a scale consists of 13 notes. A basic chord consists of 3 notes, the first, third and the fifth note. This fifth note is the dominant of the base notes, which also is the eighth note of the scale. Now, when you divide eight, by thirteen, the answer is going to be 0.61538… This is an approximation of a golden ratio. Furthermore, the numbers I have mentioned, 3,5,8,13 are all numbers in the Fibonacci series.
There is another famous example of a golden ratio, and this can be found in Mozart's sonata piece. A sonata can be divided into three movements: exposition, development, and recapitulation. As an example, there are a total of 100 bars in Mozart sonata 279 No1. The first 38 bars are in the exposition, and the last 62 bars can be categorized in the development and recapitulation. Now, when you divide 62 by 38, the answer is going to be 1.61538, which is the golden ratio.
In this presentation, the further uses of the golden ratio in music will be noted, and suggestions will be given regarding some fascinating ideas of how it could be applied additionally.

MP16. RATES AS A SOLUTION TO EVERYTHING

Yegor Kim, Pavel Burya, Konstantin Popov
International School of Moscow, Russia

In the mid-17th century, a huge mathematical leap was achieved which shaped modern Mathematics to this day and enables the description of a multitude of concepts. The discovery of the derivative was, however, not the typical effort of a mutual scientific organisation, but a race to a common milestone in Mathematics; namely, the ability to express a process by using its rates and by studying an object or notion continuously changing. It is to this day arguable as to whom the status of the 'Father of Calculus' should be attributed to between Newton - the popularizer - and Leibniz - the first person to derive the proof for the actual definition of a 'derivative'.
This presentation will dig deeper and identify the intricate mechanisms linking changing rates to their underlying process - i.e. rate of changing velocity as an indicator of acceleration - and found that a range of professions can link rates in order to find solutions for notions such as predicting currency rates and so on via the use of differential equations. Alongside identifying several examples of differential equations and their applications in real life, the focal point will be an everyday scenario: you become ill, go to the doctor and he prescribes medicine. What concentration of medicine will be in the body at a certain period of time, and which one is more effective over a certain time period?

MP17. MATHEMATICS IN ART

Qishi Xie, Platon Sagun
The Heritage Private School, Limassol, Cyprus

Mathematics and Art are related in a variety of ways; mathematics has itself been described as an art motivated by beauty. Our project focuses on mathematics in design and fine art. How have mathematics affected the world of art? Through linear perspective, the analysis of symmetry and the presence of mathematical objects such as polyhedrals and the Möbius strip in artworks. In the painting of Melencolia I by Albrecht Dürer we see a frustrated thinker sitting near a truncated triangular trapezohedron, a sphere and a magic square. Leonardo da Vinci's illustration of a rhombicuboctahedron is clearly inspired from a mathematical background. Islamic patterns resembling mathematical fractals can be discerned on the walls of Bibi-Khanym Mosque, too. Finally, could we detect mathematical principles in art? Indeed, the application of the method of enlargement or the golden ratio can be observed in artworks such as Mona Lisa and the Parthenon. Also, analysing Van Gogh's Starry Night one can find a distinct pattern of turbulent fluid structures described by Andrey Kolmogorov's law of turbulence.

MP18. INFINITE CHOCOLATE? YES, PLEASE!

Shengkun Zhao, Yufan Tang, Yawen Yang
The Heritage Private School, Limassol, Cyprus

Have you ever thought that eating chocolate helps you while working on mathematics? If you did, then how about using simple mathematics to get more chocolate? Firstly, we studied the “Chocolate trick”. Seemingly, when one has a bar of chocolate, they could produce an infinite amount of chocolate from it, following a series of steps. Unfortunately, our analysis yielded that in our realistic and mathematical world, we can only eat the same, finite amount of chocolate we initially had. Furthermore, we studied candy dispensers. We gathered information, carrying out experiments. Then using statistical analysis and finally with an ANOVA test we decided on the optimal way to get the maximum amount of candies out of a candy dispenser, spending a constant amount of money.

MP19. MATHEMATICS IN SOLAR SYSTEM

Tara Tetec, Leo Bradić
Primary school “Braća Radić”, Koprivnica, Croatia

Today we are 13 years old on Earth, but we ask ourselves how many years we would count if we had lived on some other planets of our Solar system. We know it isn’t physically possible to live on other planets, but let’s just pretend that the conditions for life are the same as on Earth. Weird thing is that on some planets we could be older in days, but younger in years and opposite.
Planets of our Solar system are so much different. Some planets are hundred times bigger or more massive than other small planets. Many planets don’t have solid surface and are made just of gas. There are some moons in our system that are bigger than the planet Mercury and there are some moons which are maybe better for life than Mars.
It is very interesting to think about planets. We will present them by comparing their masses, distance from the Sun, the length of their year, speed of their movement, and many other physical data.

MP20. MATHEMATICS ON GEOGRAPHICAL MAP

Jakov Koštarić, Damjan Koštarić
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Mathematics is everywhere around us, even when we don’t notice its presence. It can be complicated when there is a hard task to solve. At the same time it can be very amusing if the task solution we are looking for must solve our practical problems.
Geography is full of practical problems for which we need mathematics as a tool to come up with solutions. This is why knowing mathematics means you can be a good geographer too. For instance, only with good mathematical skills can you transfer round shape of the Earth and distances between places to the flat surface of geographical map.
Mathematics and Geography are connected and linked and we will try to show that combined together they can be very amusing. By using mathematics we can solve complicated geography problems and show that “complicated” mathematics is the only way to simplify our lives and better understand our planet Earth.

MP21. MATHEMATICS IN GEOGRAPHY

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The first things that we've met with in Geography have been the shape and size of the Earth, radius and diameter. Thanks to Geography we learned how to use meridians, parallels and coordinate system, for which we also need basic knowledge from mathematics. Fractions, dividing and multiplying are also necessary if we want to read the world maps or find interesting places on Earth. One of these places are Easter islands.
Easter islands are located in south-eastern Pacific Ocean, exactly at 27°7' S and 109°22' W. They are one of the farthest islands from land west from South America. The islands were a home to an ancient tribe. Now they belong to Chile. What the islands are most famous for are the mysterious statues of what seems to be people’s heads. The name of the statues are Moai.
We will describe Easter islands by using geography and mathematics knowledge.

MP22. CHECKMATE!

Matko Stanić
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Behind the legend of the invention of chess and the reward to the inventor is an interesting mathematical story. The inventor of chess requested his monarch to reward him by filling all 64 spaces of the chess board with wheat seeds by placing 1 seed on the first space, 2 on the second, and on every next one twice as much as on the previous one. The monarch was surprised by his humbleness with such an easy task and modest reward.
Usage of the (mathematical) power with a base 2 leads to an impossible reward for all 64 spaces as that many wheat seeds is impossible to produce in a year.
By elaborating the power of numbers, we come to interesting and shocking data that we can apply to the real world. For example, to fulfill a quarter of a chess board, under 3kg of wheat seeds is required, as for a half of the board we would require around 200 square kilometers, which is the size of Koprivnica and its closest surroundings.
To fill 3 quarters of a chess board it would take 16 years of the worldwide production of wheat seeds, and for the whole board it would require an incredible 1 million years of the worldwide production.
Math is wonderful!

MP23. MATHS AND MINECRAFT

Jakov Gregurić, Borna Sočev
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We chose this topic because Minecraft is what connects the two of us. The simplicity, symmetry and geometric shapes and solids are the most interesting parts of the game. It is also interesting to notice that the game allows the players to be creative; they build worlds that look like something that came from the little squares in a math notebook. Basically, we both enjoy the shapes of the objects and materials in Minecraft made of blocks and parallelepipeds.
We will analyze how many objects, blocks, tools, weapons and food can fit into a single Minecraft double chest used for storage, in a space the size of 1x1x2m. We will calculate the density and mass of the chest with all the objects in it by using the formulas for calculating area, density and volume of a block and parallelepiped.
The results will help players build quality setting of the game faster. When we find the exact number of objects for a particular chest, we save time in building it. Quicker problem solving will give us a better result and progress in the game. If a player finds solutions quicker, the pleasure of playing the game is bigger. However, the biggest pleasure is that a better result in the game happens because of mathematics. That shows us the connection between math and the videogame, and makes the connection between math and real life clearer.

MP24. THAT TRICKY MATH

Noel Mađerić, Petar Šajfar
Osnovna škola “Antun Nemčić Gostovinski” Koprivnica, Školska 5, Croatia

We use our knowledge in mathematics in everyday situations. People often think that math is dry and boring, however, there is an amusing side of math as well! Magicians have always fascinated their audiences with their performances and tricks. It is important for a trick to be confusing and to look more complicated than it really is.
Lately, we can see more and more math tricks, riddles and brain teasers. Math, in its shape and form, is present in different games, such as chess and 9 men's morris (the mill game), and math brain teasers like sudoku and KenKen. Tricks can be inspired with everyday math terms, expressions and arithmetic operations. Riddles with numbers, where you have to guess an imagined number of the persons you are talking to, are becoming more and more popular. For most of those riddles and brain teasers you need to master the basic knowledge of mathematical operations. Of course, a convincing performance of the magician is also important so the trick would be successful, but without the math knowledge, the trick will fail.
We will present to you some math tricks and riddles from everyday life which you can apply in any situation and which can be presented by anyone who has basic mathematics knowledge.

MP25. THE MUSIC OF MATHEMATICS

Ava Magdić, Nika Robotić
Osnovna škola “Antun Nemčić Gostovinski” Koprivnica, Školska 5, Croatia

Throughout the history of mankind, music has always had a significant part in human society. Songs and dance have been parts of different ceremonies and rituals. Music is present in everyday celebrations. People listen to music in both happy and sad moments as well as just for fun or out of boredom. Dance is a performing art but also a very healthy recreation.
There are different types of instruments, different types of music and different types of dancing. One of the things they have in common is that mathematics is immanent in all of them. In some fields of music mathematics is visible, while hidden in others. It is present in music notations, counting beats and dance choreographies. Also, some parts of mathematics are composed in beautiful compositions. Mathematics and music are actually strongly connected, so musically gifted people are often great mathematicians as well.
In our presentation we will present the connection between mathematics and music and we are going to dance in the rhythm of mathematics too.

MP26. THE TITANIC IN NUMBERS

Katja Gregurić, Eva Pintar
Osnovna škola “Antun Nemčić Gostovinski” Koprivnica, Školska 5, Croatia

Mathematics is present in all walks of life, shipbuilding included. The way a vessel looks, the materials used, the size of the ships, the power systems, all that has been evolving over the years, but to build a ship you always needed a specific kind of knowledge - in math. Mathematics plays an important role in the engineering world and constructors need vast knowledge in mathematics to build a functional ship.
One of the most famous ships and the champion of the British shipbuilding of the day was the Titanic. Many tales were told about the Titanic, movies were made, songs were sung. Let us tell you the mathematical story behind the Titanic.
The Titanic is rich in geometric shapes and solids in its construction, but also in the ornaments of the ship's inventory. It is interesting to compare the size of the Titanic with other objects from the same time and from today. The Titanic has interesting statistical data in every possible way. We will research and explore how many passengers there were, how many survivors, what the chances for saving their lives were and many other aspects. We will present to you a series of numbers describing the magnificence and the luxury of the Titanic, along with the numbers explaining its tragic end.

MP27. MATHEMATICS IN BUILDING HOUSES

Izabela Lugarov, Matej Matijašić
Osnovna škola Fran Koncelak, Pemija 72, Drnje, Croatia

The connection between mathematics and construction has been around since ancient times. All the old nations applied mathematics to the construction of various buildings. At that time, architects were also mathematicians, and vice versa mathematicians were also architects. Some of the earliest examples of mathematical principles in architecture are the Greek temples.
Without a basic understanding of mathematics, it is impossible to build houses. In this presentation we will show how mathematics is related to house construction. How much material we need to build, what will be the dimensions of the house and how the appearance of the house is related to geometry. We want to show that without mathematics there would be no houses and then neither the villages and the cities.
Math is not just calculus but something that is related to the whole world and we will show it on an example of building houses. Math is all around us.

MP28. A HISTORY OF THE METRE

Maia Kristina Arhall Bergendorff
Rygaards International School, Denmark

Do you ever wonder, what a metre actually is? Why is it 100 centimetres long? How it was created and defined? There have been a large variety of explanations and definitions, from an approximation based on the size of the Earth to the speed of light in a vacuum all of which have been put in place by the International Bureau of Weights and Measures. And on that note, who are they? Today, the metre is used everywhere, to measure the length of a commute, to measure weight, and even to travel to the moon. We as humanity need the metre to prevent flaws and accidents, from minor to major, and to be able to communicate. In history the metre and its definition has changed drastically in accuracy and along the way many mistakes have been made. In this presentation you will hear about the past and the present of the metre and where it has fit into the world.

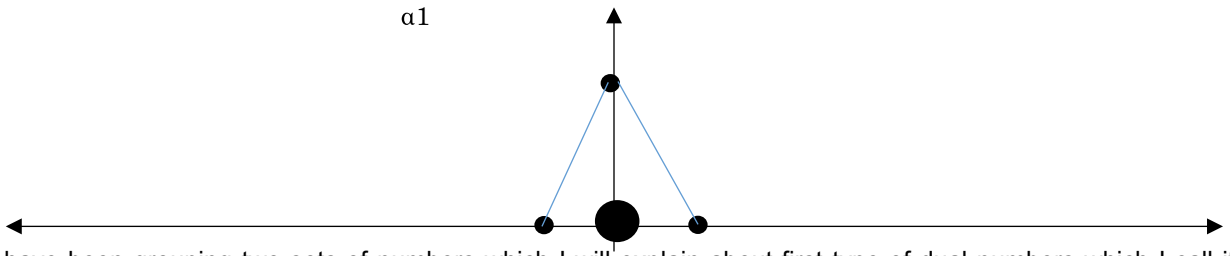
MP29. TWO FACES NUMBERS

Ali Bulori
Shahid Beheshti 1, Iran

In 19th century Physicist claimed that light can be particle and wave in same time .What if the same pattern is happening on numbers but we never thought about it? In Pure Mathematics its known $i^2 = -1$, in scientific community this phrase is agreed by most of scientists. But some of the rationalists think that "Why should a number or variable in the power of 2 become positive?" so it's more logical that we think of Imaginary numbers and the hidden mystery of them. I prefer to call them dual numbers and show it with the symbol α.let's say $\alpha 1 = [1,-1]$ of course this is not a set just to mention it is both 1 and -1,it is unbelievable isn't it!!! Back to the light theory the people didn't believe it either, at least today it is agreed in quantum physic society. if we power this number to 2 then:

$$\alpha 1^2 = [1,-1]\ \ [1,-1] = [1,-1,-1,1] = [1,-1]$$

and if we consider one of the forms of it we will have -1,doesn't that remind you of i ,actually i^2 is another way of Multiplication of two faces of $\alpha 1$,if you are a bit confused let me show it with a diagram.



I have been grouping two sets of numbers which I will explain about first type of dual numbers which I call it simple dual numbers, and I will talk about multiplication, power, sum, subtraction and the absolute value and… of these types of numbers.

-This is the solution-

MP30. TRIPLE JUMP

Julian R. Trott, Tamás Kovács
Rygaards International School, Denmark

Have you ever heard of the Triple Jump? It's a sport where an athlete sprints thirty meters, takes a hop, skips once and then a giant jump - all of these without touching the launch border - and then finally lands in an outstretched pit of sand. The world record was set as early as 1995 by Jonathan Edwards, with an astounding distance of 18.29 meters. Since then, in the Olympics, no one has beaten the record, with the closest distances reached being around 15 to 17 meters. The question naturally arises: what would it take to beat the record?
To be able to beat it you must first understand how it works. Mathematics can help. The athlete must try to reach his maximum speed during the 30-meter sprint and then launch himself perfectly from the jumping point, precisely in front of the border line, and jump as far as possible. What is the human limit for the triple jump? And how can an athlete reach it?
In our research we attempt to find out the limit for the triple jump by using aerodynamic graphs angle trajectory calculations, past performance data as well as various human physical limits, to calculate the answer.

MP31. GRAPH THEORY PROBLEMS AND APPLICATIONS

Neven Lukić
Gimnazija "Fran Galović" Koprivnica, Croatia

Graph theory is the study of graphs, which are mathematical structures used to model pairwise relations between objects. Graph are often used in math, logistics and computer science to describe and model data relations and data flow. In those areas graph theory is very useful as it provides certain formulas and methods to solve problems related to graphs. Examples of those problems could be discovering the shortest path between two points, finding the longest path between two points, finding a path that goes through all graph vertices and many more. This area of math is incredibly useful for simplifying huge problems and finding out elegant solutions for them. Google maps, delivery services, transport services, firefighters, hospitals… they all heavily use graph theory due it's amazing real-world application.

MP32. FIBONACCI SEQUENCE IN NATURE

Karla Šmitlehner, Marta Šola
Gimnazija "Fran Galović" Koprivnica, Croatia

Fibonacci sequence is literally all around us. We are looking at it every day whether we are aware of it or not. For example, we usually just look at a tree and we simply see the tree. We do not see how nature sorted the leaves on the tree perfectly. Let's imagine that that exactly the same tree has flowers. And here we are again, we just see a flower we don't see Fibonacci sequence in it. Now we could talk about other places where we can find Fibonacci sequence in nature for very long time because the nature is full of it. It seems like nature is made with the pattern and Fibonacci sequence describes that pattern in a perfect way. We want to show you that pattern; we want to show you how mathematics is literally all around us and how we are not aware of it.

MP33. MUSIC AND MATHEMATICS

Klara Smiljanić
Gimnazija "Fran Galović" Koprivnica, Croatia

As It has been proven that it takes 4 years to improve a child's mathematical skills if they are playing an instrument. Of course that isn't the only connection of music with maths. A few other are music charts, scales, notes, metronomes, time signature and so on. Mathematics is present in all of these but often we oversee that fact and in this presentation you will be able to find out more about these connections.

MP34. MATH IN FITNESS

Klara Šestak, Neven Lukic
Gimnazija „Fran Galović" Koprivnica, Croatia

Fitness isn't just a matter of going into the gym and eating good foods. Of course it can be done in such matter but poorly. To be decent at it one must use maths in fitness and have numbers in mind when going to the gym and preparing food. Firstly, in the gym one must use percentages in order to determine what weights are to be used and also use a scale of numbers to determine the intensity of a workout. Secondly, one must use simple math but plenty of it to determine the number of calories, distribution of macronutrients and micronutrients. Lastly, one can use maths to calculate bodyfat percentage. I will try to explain all three points and make it fun.

MP36. THE PERFECT RACKET

Carmela Ciampi, Simone Di Dio, Chiara Iscaro, Laura Lanni, Antonio Pezzulo, Martina Varricchio
Liceo Scientifico "G. Rummo" Benevento, Italy

Have you ever played a tennis match and been disappointed by the outcome? If so, have you wondered why? Perhaps, you immediately thought that you trained not enough or you questioned your abilities. In reality, studying it from a technical point of view, the outcome of the match could be due to your equipment, in particular to the racket. An essential element for every tennis player, depending on the weight, dimensions and material, the racket can influence your performance. Over the years, there have been considerable variations: from 430g wooden rackets to 200g aluminum alloy rackets. We can see that the heavier racquets have advantages, due to the effect of the mass on the speed of the hit ball. We can prove this by using the law of conservation of "momentum": M v1 + b s1 = M v2 + b s2 where if v1 and v2 do not vary much between one racket and another, increasing the mass of the racket increases the speed end of the bal. Another important property of the racket is its "flexural rigidity", which affects the impact with the ball. A flexible racket bends more during the impact, as opposed to a rigid one. However, the considerable progress made in sports equipment has some disadvantages. Many viewers complain that the pace of the game and, above all, the excessive speed of the beat are making the games boring to watch. This is especially true for surfaces as fast as the grass fields used at Wimbledon.

MP37. STUDYING MATHEMATICS AS A PIECE OF ITALIAN FOOD

Amoriello Pietro, Bovino Stefania, Iannella Alessia
Liceo Scientifico "G. Rummo" Benevento, Italy

Today, pizza is an almost inevitable staple food on the planet. It can be a complete and balanced dinner because it is very rich in nutrients.What does pizza have to do with math? It is a passion, of course, an art, a national symbol, for someone almost a religion. But pizza is also mathematics. An aspect of the pizza that we analyzed is about the convenience of buying a pizza maxi or normal. Moreover we have analyzed also the "pizza theorem", which deals, with the division of an ideal circular pizza between two people eating the same quantity, having as a point of intersection of the straight lines that divide the pizza, any point different from the centre. We also asked ourselves if it was possible to link mathematics with another Italian specialty: pasta, particurarly spaghetti. Is it possible to break a raw spaghetti in two without ending up miserably crumbling it in three or more pieces? The researchers of MIT of Boston have discovered thus succeeding to win the "spaghetti-challenge" that for decades has tormented mathematicians and physicists. The solution of the puzzle will also have important applications outside the kitchen: it will help to understand the broken mechanisms of many stick structures, such as microtubules present in cells.

MP38. SMARTPHONE AND MATHEMATICS

Giovanna Iannella, Alessandra Carla Coletta, Roberta Romano
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How do we usually charge our smartphone? How can we share photos? How do we take photos? For all this applcation we need numbers; these are used, in particulare complex numbers, in all the branches of mathematics, physics, engineering, electronics and electrical engineering. If you are going to send an e-mail to your boss or a message to your boyfriend you might connect your iphone to a local network but this system is based on a series of equations that involve sine curves which allow us to stay in contact with our realtives and our friends.When we are scrolling our ‘home’ on Instagram or Facebook we are very close to mathematics and we don’t notice it. Statistics and probability are the mothers of social media, thanks to them we can know which is the best time to post a photo and to receive the maximum number of like, we can know how many people watch our contents and if someone in particular have seen our post or not. Essentialy to use a smartphone we need mathematics.

MP39. SADDLE UP!

Ciavanni Annachiara, Citarella Alessia, Lepore Liliana, Pellegrini Maria Helena
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In geometry, a paraboloid is an open surface, generated by rotating a parabola about its own axis.
It is identified with two types of quadric: hyperbolic and elliptic. A quadric is an algebraic surface of degree two.
The first part of the project presents the two types of paraboloid.
The second part links the hyperbolic paraboloid to the well-known shape of the potato chips “Pringles”.
In fact, if you often eat Pringles, you should know that it is very difficult to find a broken potato chip in the pack. Everything is due to the hyperbolic parabolic geometry of each chip.
This gives to the pringles the definition of "algebraic chips".
The double intersecting curvature of the hyperbolic paraboloid prevents the formation of a stress line and the natural propagation of a crack.
Moreover, the characteristic saddle shape makes it easier to stack the chips in the space-saving cylindrical package, that further reduce the possibility that a potato chip may break.
Finally, the third part shows an application of the hyperbolic paraboloid to the construction of shell-roofs in modern architecture and structural engineering.
In fact, hyperbolic paraboloids are easy to construct using a series of straight structural members, and increase structural performance, while they seemingly have complex designs.

MP40. QUANTUM COMPUTERS

Antonio Pezzulo, Carlo di Pasquale, Chiara Iscaro, Giuseppe Viglione, Lorenzo Addivinola
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How does it work and what is it?
Traditional computers are based on binary logic. Each unit (the bit) is an alternative between 0 and 1;. Quantum computing exploits the properties of quantum physics, making computers "reason" differently, not linearly, with a new processing unit: the qubit, both 1 and 0 at the same time. Quantum computers watch at the entire problem, reducing the number of calculations necessary to solve it.
What can it do?
Quantum computers can execute different operations, such as quantum physics' simulations. But now it can only do determined things, such as analyzing financial data and do complex operations. Another application is encrypting passwords that are almost impossible to decrypt. Also creating simulations of collisions between subatomic particles will be much easier.
Google’s quantum computer
The newest Google’s quantum computer is composed of 53 qubits that can store 253 informations, and more than 10 quadrillion possible combinations. It was used to solve an incredibly complex problem, but it’s still far from perfection. It can only do specific calculations. But in the future it will be able to execute operations that nowadays are impossible for the fastest supercomputers.
What will it be used for?
In the chemical-biological field there are numerous possible applications, from pharmaceutical research to the creation of new materials.
In the medium term we can also hypothesize applications related to simulations and big data. In the long term it is possible that quantum attacks can break some of the most secure cryptographic algorithms.

MP41. PROBABILITY OF FOOTBALL BETS

Giorgio Benedetto Bravi, Giovanni Catauro, Bruno Nesticò, Piofrancesco Rosella, Rinaldo Saviano
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In Italian schools the first and only approach to probability is the "classical" one: the probability of an event is the number of favourable outcomes over the total number of outcomes. This approach has many advantages but if taught to be the only one it may generate confusion between probability and counting, typically focusing only on cards, dice and coins problems. Therefore, it is important to show that probability has much wider, and more relevant, applications as well as different approaches. Particularly we dwelt on the subjective approach to probability, the most comprehensive model, which involves personal opinions usually based on past experiences. We decided to take an in-depth look at football bets using mathematical methods. The analysis of some case studies has allowed us to understand when a bet can be considered fair or not bringing to light the “hoax” of the bookmaker which always retains a percentage of the money bet.

MP42. NETFLIX: AN ISSUE OF RECOMMENDATION!

Fiorentino Giuseppe Manuel, Fucci Francesca Pia, Paduano Francesco Agostino, Guerrera Concetta, Addivinola Lorenzo, Viscio Viglione Livia
Liceo Scientifico “G. Rummo” Benevento, Italy

What will be the next movie we will love on Netflix? Or the next video we'll watch on YouTube? And the next song on Spotify? But above all, nowadays can we be certain that our tastes are exactly ours? The fact that computers propose us always items that meet our tastes, could appear illogical and unreasonable, but the secrets are some easy mathematical algorithms. As just said Netflix, the colossus of the streaming, is one of the sites that works in this way. For this reason, we are going to analyze how Netflix is able to offer us the perfect tv series, and properly its recommendation system.
Using a mathematical approach the problem would consists of predicting the preference of an user, basing on the items that he had already bought, therefore the site will be able to create a list of products similar to the tastes of the own user.
In order to solve our problem, first of all, we use the Pearson’s correlation to understood how much two products are similar.
Then we have to predict the vote that the user will express using a formula that include our correlation and the past preferences.
Are you probably thinking that this is easy? it’s wrong because bearing in mind the amount of users that Netflix has the algorithm add always new information. In a nutshell we have briefly explained the secret of Netflix and the reason of its popularity. So we hope that when you will be watching a new tv series you will have been remembering its mathematical origin.

MP43. LOVE AND MONEY

Giuseppe Abbate, Giuseppe Viglione, Mariagaia Miranda, Francesca Lacerra, Giorgia Iammarino, Carlo Di Pasquale
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Love is one of the most discussed and fascinating topic of human mind, but mathematics can help us here too. Unfortunately not everyone has the pleasure of being involved into a relationship. But we are not here to demoralize you. In fact we are going to show you some examples of people (in particular one) who ,thanks to a hearthbreak, have achieved a very important place in the world’s society. We will firstly show you how to calculate the probability of finding the so-called “twin soul”, through a specific formula ,rearranged from the “Drake equation”, strictly related to “Fermi paradox”. With this promises, our purpose is showing you that, despite this probability, every cloud has a silver line. To prove it, we will take as example one of the richest men in the world, Mark Zuckemberg. We will calculate his annual income, trust us, a very large income, basing our calculations on the “Bitcoin”, an anonymous currency used particulary in this decade. The reason is simple, the use of bitcoin will let us know the real value of his hearthbreak, considering also the possibility of tax evasion, not a noverty for rich personages, given that the issue of bitcoin is exactly the facility to cheat on law. As a result we can get that, even if whatever link could seem impossible, mathematics is everywhere.

MP44. LET'S GIVE IT A CUT

Boffa Maria Giulia, Fiorito Alessia, Giangregorio Luigi, Napolitano Swami, Verderosa Ciro, Verderosa Giuseppe
Liceo Scientifico “G. Rummo” Benevento, Italy

Our project stems from the growing concerns about the environment and it's focused on the production of photovoltaic energy by proposing an original solution using the geometric concept of origami. Origami have been analysed by astrophysicists for a long time, because they could all be folded and packed into a single rocket launch, with no astronaut assembly required. One technique that has been used for an origami-inspired solar array is called a Miura fold. When the structure opens, it appears to be divided evenly into a checkerboard of parallelograms. The NASA, inspired by Miura fold, developed a fotovoltaic panel able to reach a 25m diameter starting from a 2.7 one, generating about 250 kW of energy. It’s used a specific material and a technique called Hannaflex. We therefore decided to apply our project on our school (34m wide and 50m long, for a total of about 1500mq), using first of all normal photovoltaic panels and then the futuristics "origami-panels". According to an expert, the power of a plant necessary to cover the energy that an area of 1500 square meters needs is 50 kw. With an average of 300 days of activity per year, considering the activity of the schools from September to June, and a daily average of 10 hours, our energy requirement will be 50Kw * 3000h=150000Kwh. Because the system is not always active, we worked using a power percentage of 70%. 1 kW of energy=0.20 euros; Annual bills=21000 euros (2100 per month). Solar panels application cost=75000 euros.

MP45. INSTAGRAM: LET’S REVEAL ITS SECRETS!

Francesco Agostino Paduano, Laura Lanni, Martina Varriccchio, Maria Gaia Miranda
Liceo Scientifico “G. Rummo” Benevento, Italy

Essential in the daily life of every teenager and not, social networks take on a vital role in generating contacts, maintaining relationships and, sometimes, expanding their knowledge. According to the study carried out by "We Are Social" and "Hootsuite", Instagram is positioned on the podium, alongside Facebook and Whatsapp. With is new updates, his stories and his thousands of hashtags, Instagram is the social that is spreading out mainly between teenagers. For this reason we have searched the secret of this fantastic social, and of course we want to share it with you. So what do you think is the success key of Instagram? The answer as always is MATHEMATICS!
As many researches have shown, behind each post there is a precise algorithm based on functions that take into consideration different factors like: interactions, engagement, views, fans, generic constant and time. The order of the photo and videos in your feed will be based on the probability that you could be really interested in that content, your relationship with the person who publish the post and the its promptness.
Apart from this algorithm, as said before math can be applied on every Instagram functions like filters. With the recent updates this social has add lots of new fashionable filters. Their strong point is the application of a very simple math operation: the convolution. The convolution is an easy concept that use different matrixes, like the kernel. In our case the matrix works on each pixel of the photo causing its changings. In conclusion with our presentation we will briefly explain how mathematics it’s behind everything, even behind a social network that we use daily.

MP46. EVERYTHING IS NUMBER

Boffa Annachiara, Ferravante Sara, Fiorito Alessia, Napolitano Swami, Viscio Viglione Livia
Liceo Scientifico “G. Rummo” Benevento, Italy

In this presentation we will find out if there are links between mathematics and the universe. We wondered if Pythagoras, with the phrase “everything is number” was right. Well, Pythagoras with this sentence meant that numbers are at the origin of all that exists, in other words, number is the archè. Nothing in existence is to chance, everything is a flow connected to a perfect geometric matrix, everything follows a precise order in a harmonious balance. Every day we see around us geometric shapes and regular designs, it is clear that they are the result of a project, as Pythagoras said. The dome of Santa Maria del Fiore in Florence is too beautiful to limit us to look at it with the nose up. This time, however, we look at it from a different perspective: in search of mathematics. Already from the dimensions we realize a certain harmony between the parts: the dome starts from a height of 55 meters, rests on a tambour of 13 meters, is on average 34 meters high and is surmounted by a lantern of 21 meters. These numbers, which apparently seem random, are instead part of the succession of Fibonacci, in fact what counts of these numbers, is their ratio, which tends to the golden ratio. In a nutshell Pythagoras’ intuitions of the fifth century remain current and consistent.

MP47. CANDY CRUSH'S PUZZLING MATHEMATICS

Francesca Pia Fucci, Concetta Guerrera, Francesca Lacerra, Carmela Ciampi, Maria Giulia Boffa
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It’s been said that in a city, you’re never more than a few feet away from a rat. But these days it seems more likely that you’re never more than a few feet away from someone playing Candy Crush Saga. Candy Crush is by far the most popular mobile game in the world. But what makes this innocuous pastime so addictive?
A big part of the appeal of Candy Crush for players is that there are complex bases to the seemingly simple puzzle; surprisingly, it offers insight one of the most important open problems in mathematics, as well as into the security of computer systems, which might be why it’s so obsessive.
Toby Walsh, a researcher at the University of New South Wales in Australia, in 2014 took a look at the game and found that Candy Crush Saga belongs to a subset of NP-hard problems. Solving these problems quickly becomes more difficult as their size increases, making larger versions of them impractical.
NP lies right at the boundary between easy and hard: problem where it is easy to check answers but hard to find them. To show this the game can be turned into the equivalent of a logic puzzle, by devising a model electrical circuit made of candies. Consequentely the puzzle in playing Candy Crush is deciding which switches to set so that the output bit is set to true.
You might like to explain this the next time you're caught trying to get *just one more level.*

MP48. SWINGING MATH

Federica D'Agnese, Serena Pagano
Istituto Statale per l’Istruzione Secondaria “Europa”, Pomigliano d’Arco, Naples, Italy

A swing is a lever, a simple machine consisting of a rigid rod able to move around a fixed point called fulcrum.
The aim of our presentation is to explain to other students the concepts of center of gravity, static and dynamic equilibrium in an enjoyable way.
Moreover, our presentation will talk about arithmetic mean and weighted average.
We asked ourselves how it is possible to predict the equilibrium situation by determining the center of gravity. We simulated a situation of equilibrium of several masses having different values using a website application: Phet Interactive Simulation of the University of Colorado.
As Archimedes said: “give me a place to stand, and a lever long enough, and I will move the world!”

MP49. WHEN FOUR CURVES MEET

Panagiotis Bampatsias
Varvakeion Model High School, Greece

The purpose of the present paper is to examine the problem concerning the description of the analytical components of the real polynomial graphs passing through a point. Let's assume that the graphs of n polynomials concur in point O, which is the intersection of the two axes. We consider a decreasing sequence of polynomials p1(x)>p2(x)> …. >pn(x), for all x close to the left side of the common point, coded by the input set {1,2,3,…,n}. Our goal is to verify experimentally Victor Kleptsyn's theorem related to the number of possible permutations of the input set over the the right side of the common point. For three polynomials (p1, p2, p3) intersecting in point O there are 6 (=3!) different combinations, which are all possible to appear on the right side. The goal is to examine if all the combinations are possible to appear on the right side of point O for more than four polynomials.

MP51. 1,2,3…N DIMENSIONS IN GEOMETRY

Emilia Biamonte, Martina Umbrello
Liceo Scientifico "Luigi Siciliani" Catanzaro, Italy

Any physical phenomena that occupies space in time has to be described by coordinates and the optimal minimal number of coordinates required for this description determines what is called the dimension of the space-time. In Geometry, the notion of dimension is an extension of the idea that a line is one-dimensional, a plane is two-dimensional, and space is three-dimensional. We can also considers higher-dimensional spaces, such as four-dimensional space-time, where four numbers are needed to characterize a point: three to fix a point in space and one to fix the time. Infinite-dimensional spaces, first studied early in the 20th century, have played an increasingly important role both in mathematics and in parts of physics. In differential geometry, one considers curves as one-dimensional, since a single number, or parameter, determines a point on a curve—for example, the distance, plus or minus, from a fixed point on the curve. A surface, such as the surface of the Earth, has two dimensions, since each point can be located by a pair of numbers usually latitude and longitude. In 1918 the German mathematician, Felix Hausdorff introduced the notion of fractional dimension. This concept has proved extremely fruitful, especially for the mathematician Benoit Mandelbrot, who coined the word fractal and showed how fractional dimensions could be useful in many parts of applied mathematics.

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MP52. TELL ME WHAT YOU EAT AND I WILL TELL YOU WHAT YOU ARE

Alberto Pesce
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Everyday millions of people in the world are at risk of starving while millions of people are wasting food.
However, what we eat can actually be a health risk factor as a cause of huge public health problems.
These issues caught our attention and we decided to get to know our eating habits.
The study is divided into the following phases: data collection, revision and analysis, elaboration and summary, conclusions.
We used statistics to learn new things. Statistics deals with many things that happen in our life and that manifest themselves differently for each individual or situation.
Statistics tries to extract the "juice" from huge quantities of information, to give voice to the numbers and we really liked to use it. With the help of the Italian Statistics Institute we collected our data through a questionnaire, then we used Microsoft Excel to revise them. Then, we built a series of pivot tables (to summarise the information) and we were able to establish the real weekly consumption of the foods we use. We measured the percentages of what we eat and compared them with the Standard Food Pyramid.
To sum up, we understood the importance of statistics and of healthy food habits.

MP53. MATHLETICS

Andreas Hadjikallis, Eleni Papachristoforou, Anestis Louca, Maria Zorni, Thalia Theodorou
American Academy Larnaca, Cyprus

Sports play a very important role in all people‘s lives. Although not always realised, mathematics play a very important role in sports. It’s all about PROBABILITIES! Whether discussing a player’s statistics, a coach’s formula for drafting certain players, or even a judge’s score. For a particular athlete, mathematics are involved. Our team will be exploring the significance of mathematics, especially probabilities in the area of sports. Most people are familiar with sport rules and technology; however, they are not always aware of the catalytic role that maths play in sports. Maths are actually everywhere… An example is the win-loss percentage. Such a percentage is calculated by taking into account the number of games as well as the number of wins and losses. This is one of the easiest percentages to be found. On the other hand, there are more complex percentages to measure such as data related to the pace of play, win shares and ball-screen defence. These statistics are very important for elite teams who are looking for a competitive advantage no matter how small it may seem. “Obvious” is the most dangerous word in mathematics and sports. Instead of playing the game dangerously, we want to find the actual truth that’s hiding behind successful teams and individual athletes.

MP54. THE REAL THE IRRATIONAL AND THE IMAGINARY

George Karesiou, Marios Americanos, Panagiotis Grigoriou, Alexandros Zachariou
American Academy Larnaca, Cyprus

The identity e^i□+1=0 is a well-known identity that can be proven mathematically. It is an identity that contains the most beautiful entities encountered in maths, namely □, i, e, 0 and 1. It combines the real and the imaginary. By explaining the meaning of i, e and □ we will prove the identity e^i□+1=0. This identity is referred to as the most beautiful identity because it includes 5 mathematical constants exactly once and uses addition, multiplication and exponentiation. The constant e is an irrational number just like the constant □. The constant e is the base of the natural logarithm: the unique number whose natural logarithm is equal to one. It is approximately equal to 2.71828, and is the limit of 〖(1+1/n)〗 ^n . The constant □ which is originally defined as the ratio of a circle's circumference to its diameter has various equivalent definitions and appears in many formulas in all areas of mathematics and physics. It is approximately equal to 3.14159. And for i... you could only imagine what it is.

MP55. MY TRIANGULAR WORLD

Galatea Evgeniou, Stephanie Demetriou, Marilia Fysentzidi, Charilia Papalambrou, Constatina Polycarpou
American Academy Larnaca, Cyprus

Can you imagine a non-triangular world? The triangle is the strongest shape found in nature. It is a three-sided and a two dimensional closed structure. It is a polygon with three vertices and three angles joined together forming a closed structure. Everything is made up of triangles! Take a look around you and you will be amazed by how many things actually form a triangle and they are unique because of that. From the sandwiches you eat for breakfast, high-level geometrical calculations you do in school to the dangerous Bermuda triangle…almost everything is triangular! Can you imagine the Eiffel tower, the Egyptian pyramids flat? The entire history would be very different and nothing would be unique about them! The triangle is a symbolic shape which has a great impact in our lives too. Believe it or not a triangle is a motive in life that reminds us that to reach the top we have to climb its length through hard work no matter how steep the line is. Triangles help you see life in a different angle and indicates that sometimes life turns you upside down but you are still the same person no matter what- like a triangle even if you see it upside down is still the same.

MP56. MATHEMATICS AND ARCHITECTURE

Erene Efstathiou, Stephanie Symeonidi, Kyriaki Paradisioti, Miranda Hadjimatheou, Maria Hadjichambi, Theodosia Hadjimarcou
American Academy Larnaca, Cyprus

We can all agree that architecture can be breathtaking. Think about the Parthenon, the pyramids, Sagrata Familia and many other magnificent buildings that are truly a work of art. Well, none of all these amazing buildings would exist without maths. That is why during this presentation we are going to show you how mathematics are an essential aspect of architecture through a 3D building design, sketching and a powerpoint presentation. Architecture mainly includes: geometry, to calculate the proportions for how structures should be constructed; algebraic formulas, to solve structural problems and issues, and for planning, mapping and developing; Pythagoras' theorem, for designing and computing the measurements of building structures and bridges; calculus, to prevent the buildings from destruction. Mathematics were always essential. Even in ancient times, people used mathematics to construct their buildings. Their ideas influenced and changed our way of thinking and building. We improved, with technology, basic building designs and made modern building structures more reliable. Concluding, mathematics in relation with architecture completely altered our lives in a positive way, since architecture is one of the main things that surrounds humans.

MP57. SOLVING CRIMES USING MATHEMATICS

Anastasia Demetriou, Danae Larcou, Eleni Apostolou
American Academy Larnaca, Cyprus

Have you ever wondered how the police solves a crime with such a little bit of evidence? Well, mathematics plays a very important role while solving a crime! Firstly, if we are speaking about a serial killer the police looks for patterns in the locations the killer has been in order to make a prediction for the next one. Also, when the police finds bodies the big questions are: was it an accident? a murder? or a suicide? Police uses measurements and geometry to find out what really happened. Moreover, after a death a body cools down until it reaches the environment's temperature, the police models the cooling rate mathematically using Newton's cooling law. Furthermore, probabilities and statistics play a very important role. Statistical analysis is used to compare sets of measurements to determine whether they are similar. Apart from this, when analyzing evidence from fingerprints, blood groups and DNA profiles, conditional probabilities enter the scene. Isn't mathematics the most important detective to solve a crime?

MP58. THE AESTHATIC OF MATH

Marina Barbara Zachariou, Poline Haroutounian, Panagiota Mela
American Academy Larnaca, Cyprus

We are constantly being told in our everyday lives that mathematics can be found everywhere! Well, it really can! By explaining the golden ratio and using phi we can apply this knowledge to almost everything. We will start this mathematical journey by incorporating phi into four different categories. Firstly, we will visit phi in humans. How it lives through our face proportions, fingers and even our DNA molecules. Then we will visit nature. We will see it unfold through flower petals, seed heads, pine cones, tree branches sea shells and even in hurricanes. You will even be surprised to see it merged with art and powerful architecture. It can be identified in the Parthenon, pyramids of Egypt, Taj Mahal and Toronto's CN Tower. It flows through Leonardo Da Vinci's masterpieces, Michael Angelo's work and even Botticelli's magnificent paintings. Lastly, we can find phi in our universe. From the distances between planets in our solar system. Phi can even be applied to the shape of our universe itself. Mathematics involves numerous special and important numbers. But none of these numbers captures the continuous flow of beauty like the golden ratio. From our DNA to flower petals, sea shells to the Parthenon, Botticelli's work to our solar system; we can identify the golden ratio time and time again as it takes different manifestations. See, by just applying this simple theory you can see mathematics from a whole different perspective.

MP59. NUMBER ART

Tea Hansson, Axel Palmé, Alva Strand
Polhemskolan, Sweden

Mathematics is sometimes described as the pure logic. Truth in its most concentrated and strict form. Even so, mathematics has its corners where it almost stops being science and enters into art. We have looked closer at some of these far off places in maths, where numbers are either perfect, weird or even untouchable.
To begin with, perfect numbers, weird numbers and untouchable numbers have at least one common denominator: they are integers. These integers can be deconstructed and split into their divisors. For instance, 6 is a perfect number. It is evenly divisible by 1, 2 and 3 and the sum of these divisors - 1 + 2 + 3 - equals 6. Hence, 6 is a perfect number.
Weird and untouchable numbers are different. They are instead made up of divisors that cannot be summed up to the original number itself. The sum of the divisors of a weird number will be greater than the original number. We have looked closer at why this is weird.
But untouchable numbers is where the magic happens. These are numbers that mathematicians have spent more than a thousand years thinking about, with studies going back to arabic scholars in Baghdad (current Iraq) 1000 AD. To this date, the number 5 is believed to be the only odd number of all untouchables. Isn't it fascinating that - in a world of super computers - we still lean on knowledge from more than a thousand years ago?
Let us guide you into the exciting world of numerology!

MP60. THE DEVELOPMENT OF CRYPTOLOGY

Astrid Hofwander, Engla Sundström
Polhemskolan, Sweden

Cryptology originates from the greek word for hidden or secret and has been used for thousands of years. Historically there has been many different varieties of cryptography, which is the encryption of information. They have been used all around the world throughout history, not least of Julius Caesar, of the Roman empire, with his nowadays called Caesar cipher.
Today these old ciphers is called classic cryptography and is nowadays considered nothing more than mere games. Modern cryptography is far more complicated often requiring a different key to decrypt the information, a so called private key. Almost everything you see on your computer is encrypted and so is information sent between devices.
In our presentation we will discuss the development of cryptology and briefly explain how it works.

MP61. EATING MATHEMATICS

Federica Petrella, Clara Verdino,Matteo Piscopo
Liceo Scientifico "G. Rummo" Benevento, Italy

Did you know that the shape of the fruit and vegetables you uswally eat is due to mathematics? We will soon give a demonstration. Let's start from pineapple; this fruit has always the same quantity of flakesbon the peel, whatever the size. It has 13 in clockwise, 8 anti-clockwise. We can explain this thank to the Fibonacci sequence. It seems incredible, but the cauliflower has its big matematical content. The cauliflower has in fact its own organization and internal structure. While a flower has it's "minimal bodies" around a central body, the cauliflower is much more complex: it has neither central body, nor minimal bodies. Detaching one of the "branches" we see that the new piece, smaller than the whole vegetable, is organized in the same way: many branches which branch out in turn. You will certainly have observed the typical round shape of the fruit, but have you aver asked yourself the reason of this? That's because fruits are axissymmetric solids: a solid that can be obtained by rotating a geometric figure around a rotation axis. In the same way the fruit tends to grow around a central core that can be a single seed or around a group of seeds placed on the main axis of the fruits.

MP62. CONVERGENCE OF FUNCTIONS OF MARKOV CHAINS. APPLICATIONS IN DISCRETE STOCHASTIC MODELS

Martin Boyanov Stefanov
Sofia High School of Mathematics, Yanko Zabunov Street, Sofia, Bulgaria

Modern probability theory studies chance processes for which the knowledge of previous outcomes influences the prediction for future experiments. In principle, when we observe a sequence of chance experiments, all of the past outcomes could influence our predictions for the next experiment. For example, this should be the case in predicting the student's grades on a sequence of exams in a course. But to allow this much generality would make it very difficult to prove general results. In 1907, A.A.Markov began the study of a new type of chance process. In those, the outcome of a given experiment can effect the outcome of the next experiment. This type of process is called a Markov chain. This project examines the asymptotic behaviour of functions g(X1,…,Xn) where X1, ...,Xn is a Markov chain and g is a Lipshitz function. In particular we prove that $\lim_{n\to\infty} E[g(X1, ..., Xn)] / n = c$ where c is a constant. We have described the applications when g is the longest common subsequence of two randomly generated words and when g is the shortest path in a site percolation model.

MP63. THE USE OF MATHEMATICS IN (AUTOMATED) TRADING

Arian Adeli Koodehi
International School of Paphos, Paphos, Cyprus

What role does mathematics play in the everyday market?
Trading is a substantial method of investing, responsible for an immense amount of money using the sale of financial instruments, such as stocks. Despite it's high profit yield, it is a very risky way of handling money. How can we minimize this risk? There are two main ways of analyzing the market, Fundamental analysis, which is based on external events and predictions that are made accordingly. Another method which will be our main focus, is Technical analysis, which uses previous price charts and market statistics to predict future patterns.
This has to be done very accurately, as a wrong decimal in the price can cost an irreplaceable loss. Mathematics is a major tool used among traders to predict the future patterns, for instance using the Fibonacci sequence, which was presented by an ancient Italian mathematician called Fibonacci, we can find different price levels based on the previous price patterns; Price fluctuations, which are upward and downward movements in the price form of a mountain like shape on the price chart, and the Fibonacci levels are determined based on different points on this "mountain". If the price exceeds a certain level, there is almost a definite chance that the price will reach the next level on the sequence. These different methods will be explained further in the presentation, aiming to achieve a better understanding of our world and applications of mathematics in our daily life.

MP64. GAME THEORY

Marko Spyrou
International School of Paphos, Paphos, Cyprus

Game theory is a branch of mathematics that is used in military applications and biology; however, it is predominantly used in economics and business. Game theory is split into two parts, co-operative and non-co-operative. But first, what is a game?Now I am not necessarily talking about board games or video games however I am not necessarily not talking about them. The thing about game theory is, is that it can be applied to so many things that you cannot say for certain if there is no way to apply it to something. For my presentation I will be focusing on the more real-life applications not the actual game applications. In my presentation I will describe game theory in the application of economics/business, giving examples of the types of real-world situations that game theory can be applied in. If granted permission I will play a small game with volunteers to demonstrate. More about game theory itself, game theory is not necessarily always about what to do in situations, but also when to do things which can be as, if not more, important than what to do. eg. A phone company (A) wants to lower their prices to sell more, this is a very important decision that could affect the company greatly in the future. The company might however, wait for an opposing company (B) to perhaps raise their price, before company A lowers its price, making it a more enticing offer. Phone company A could also purposely leak false information about raising their prices, to make the competitor raise theirs.

MP65. ALAN TURING AND THE ENIGMA MACHINE

Belegrinos Eleftherios, Karaferis George-Paris, Tsormpatzoglou George
The American College of Greece-Pierce, Athens, Greece

In this project the most famous encryption device, the enigma machine, will be presented. In fact three aspects of the machine will be explored: 1) its history, the specifics of its design and creation as well as the historical setting it was used in, 2) the technology behind the enigma machine and the process which the machine followed in order to function and scramble letters in messages, and 3) the details of encryption when using an enigma machine, the number of possible configurations one can have and what parts contribute in the process.

MP66. MATHEMATICS AND PHILOSOPHY

Juan A. Monge-Navarro Otero
Turku International School, Finland

In the following paper I will discuss the transition from Nature to Mathematics. More specifically I will discuss for example the transition of having “one” of something to a formal, abstract “one” like the “one” we deal with in Mathematics, whilst extending its definition to all rational numbers and the paradoxical nature that comes along with a concept such as “zero”. I will also discuss operations such as addition and multiplication, whilst also trying to extend it to a more general operation like we the one we deal with in Group Theory. I will further use Epistemological methodology such Kant’s Theory of Cognition to assist me in this explanation. Hereinafter, I will try to build, basic Group Theory and the rational numbers from the perceived Nature of Reality.

MP67. TOPOLOGY AND KNOTS

Talemwa Nanyange Kyambadde
Turku International School, Finland

Topology is a branch of mathematics that deals with properties of geometric shapes and formations that are conserved under deformations like twisting, stretching and so on, without not tearing or splitting the shape which is referred to as homeomorphism. One of the studies under topology is the formation of knots, called knot theory. Knots are one of the simplest, yet at the same time, complex shapes in topology. There are multiple ways of deforming a circle into a knot. I conducted a simple experiment to observe the different invariants of the knots, and explored different ways of notating the knots with Alexander–Briggs notation, which is the most common, traditional form of notation, and the Dowker notation.

MP68. KNIGHTS AND KNAVES

Asen Evgeniev Tonkov, Hristo-Chocho Tsvetanov Vladovski, Deyan Tsvetelinov Minkov
125th SU “Boyan Penev”, Sofia, Bulgaria

Mathematical logic is a subfield of mathematics exploring the applications of logic to mathematics. Logic started as a branch of philosophy but later on, it evolved joining the area of mathematics. During its evolution, mathematical logic undergoes different stages. Among these stages, the two most important are the propositional and predicate logic. Moreover, due to the development of these exact two stages, a certain kind of mathematical problems came into existence.
These problems generally are called Knights and Knaves. A Knight is only able to tell truths, and a Knave can only lie. When a character is asked to make a statement for himself and another person, he must state whether they are a knight or a knave. Therefore, in the end "the solver" ends up with several statements claiming whether the characters are liars or not. Taking into consideration all the statements one has to find the truth about every character.
Our team's work will introduce the foundations of mathematical logic and will expand people's knowledge of it. Furthermore, we will display a computer program which will have the ability to solve the problems concerning Knights and Knaves.

MP69. VISIBILITY OF CONICS

Martin Dimitrov, Gergana Peeva, Borislav Stoyanov
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We say that the figure F in the plane is visible at angle α from the point A when there exists ∠BAC=α containing F and no angle with vertex A and less than α contains F. The locus of points from which F is visible at α is denoted by αB_F. If F is a smooth and connected figure, the locus of points A for which the tangents to F through A cross itself at angle α is denoted by αT_F. The sets αB_F and αT_F are studied when α is right angle and F is a conic. These two sets coincide for parabola and ellipse but they differ when F is a hyperbola. The corresponding theorems are proven analytically. The calculations are done using Mathematica package. The animated illustrations are done using GeoGebra.

MP70. ANALYSIS OF THE GENERALIZED QUEEN PROBLEM

Ivan Ventsislavov Georgiev
Sofia High School of Mathematics, Sofia, Bulgaria

This project is in the field of "MATHEMATICS". The topic of the project is widelyspread in problems in national and international competitions. We deal with different chess pieces in it. The project contains analyzes of three different figures - queens, knights and one more sophisticated figure - the queenknight. I also have shown some of the facts that I have discovered and solved, as well as the various methods for solving them. In the first section we analyse the chessboard and its result. There we see that, when the table is smaller there are more invariants. In the second section we consider biger tables. There it is harder and almost impossible to find an invariant.
The eight queen problem is widely accepted to be a problem, which can be analysed and solved only computationally. Thus, another aim of the research is to find alternative method for solving it using mainly mathematical methods.
My personal contribution to the project is in discovering and solving problems, in presenting lemmas and theorems for the queens, knights and queenknights. We also defined and analyzed the movement of a horse on a board. Finally, we have shown applications of the open methods in several tasks in mathematics competitions.

MP71. QUANTUM CRYPTOGRAPHY

Spanoudis Nikos
De La Salle College, Thessaloniki, Greece

The scope of this presentation is the science of Quantum Cryptography. In the first part a quick description pf the classic cryptography systems, that are used nowadays, will be presented. There will be a reference to the one time pad technique and the public key Cryptography. Also I will analyze why the development of a new Cryptography system is crucial, as the construction of the first Quantum Computer belongs to the near future. The main application of Quantum Mechanics to cryptography is the Quantum Kay Distribution (QKD) to witch I will refer in the second part of this presentation. In parallel with the QKD protocols there will be a brief presentation of Quantum Mechanics related to the specific applications ,as Quantum States, the General Uncertainty Principal and Entanglement.

MP72. MONTY HALL

Marko Praček
St Stanislav Institution, Gymnasium, Ljubljana, Slovenia

The Monty Hall problem appeared in 1990, in Parade Magazine.
It reads as follows: Suppose you participate in a prize game where you have three doors to choose from. There is a car behind one door and a goat behind the others. You choose door no. 1, then the show host opens door no. 2, behind which is the goat, it is important to know that the show host knows which door the car is behind. The show host then offers you to switch the doors or stay with the doors you chose. The question of the problem is, what is more worth it to replace or stay at the same door?
On the Monty Hall problem, I made a problem experiment in the classroom. Whole prize game was staged 60 times. The result was divided into four groups, depend on what did the player choose and what was the result that he got. The results were similar to prediction of conditional probability. If we wanted more accurate answers we should did more attempts.
Monty Hall problem falls within the field of mathematics called conditional probability. Conditional probability is a measure of the probability of an event occurring given that another event has occurred. So if at first probability that the car is behind choosen door is one third, than when we know new fact the formula for probability shows us that the probability that the car is behind the door that has not yet been selected is two thirds.

MP73. COMPLEX & IMAGINARY NUMBERS

William Brander, Aatharva Kawade
Rygaards International School, Denmark

You may be wondering, are these so-called imaginary numbers are really “imaginary”? Do they have any use to us in the real world? Can they be applied?
It is of paramount importance that we recognise that mathematics is an invention, and, if you like, rules by a game we play. Contrary to Sciences, it does not have to represent the real world. Mathematics can be looked upon as a system that merely functions, and thus we can lay a set of rules to depict this. The only reason we deem 2+2 to be 4 is because we say so. Why should this be different for complex numbers? In the real number system, the square root of negative numbers do not exist, by definition. However, playing a more complex “game”, this opens the doors to a whole new universe of numbers in which it does have a solution. This new system is built fundamentally on the number i, the backbone of this approach to mathematics, also known as the imaginary unit. By creating multiples of these numbers, we can create an infinitely many more numbers of new values, applied in many different instances, such as electricity, wireless technologies, and seven brain waves. They also occur quite naturally in the study of quantum physics.
In this presentation we will play with the idea of “Imaginary” and show some possible applications of the concept.

MP74. SUNFLOWERS

Eylul Nihat
Mediterranean High School, Larnaca, Cyprus

Sunflowers are not just beautiful plants; they have mathematics behind them. The seeds of the sunflowers follow a pattern, that pattern is called the 'Fibonacci sequence' as it goes like; 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144… and many more. To get the next number we add the previous two numbers and this continues non-stop. Sunflowers have special hormones called the auxins. These hormones are sensitive to sunlight so when the sunflowers bend down to the opposite side those hormones stay in the shade and the sunflower faces the sun. We use sunflower oil a lot in real life for cooking as frying oil. It is made up from sunflower seeds. Sunflower oil helps to improve digestive but it contains fat. Sunflower oil also can be used in cosmetics as an emollient.
Sunflower seeds have compounds which are healthy for our body. They contain about 2% vitamin A and C and about 7% calcium but they highly contain iron, vitamin B-6 and magnesium. There are over 70 types of sunflowers. There are some unusual kinds of sunflowers that you never knew that they were sunflowers. Their average size is about 60.96 centimetres (2 feet). The highest sunflower was measured in Germany which is 9.17 metres long. Sunflowers like to grow in warm climates. They can grow between 21-25 degrees Celsius. During winter times sunflowers drop their seeds and they grow when it's warm enough.

MP75. BUTTERFLY EFFECT

Tuna Ercika, Ioanna Gerolemou, Veronica Camanide, Amalia Chari
Mediterranean High School, Larnaca, Cyprus

In this project, we are going to talk about the butterfly effect which is the concept of chaos theory and can be used in weather. Every small thing that happens in a part of the world can cause something very big in another part of the world. It's a mathematical theory that deals with complex systems with many variables that equally affect each other, and cannot be predictable and controllable. In this project we are going to discuss the origins of the metaphor, present a graph, equation, principles of chaos, how it can be used in the weather and many examples which provide an evidence of the effect.
Moreover, we will present fascinating facts, show you many interesting photos and finally address whether the butterfly effect is a good example or not. The choice of a butterfly's wings to describe a small act that drives big processes was made by a man named Philip Merilees. The "Butterfly effect" metaphor states with variance that the flap of a butterfly's wings in Brazil can cause a tornado in Texas. This metaphor has become a part of the common vernacular of Western culture.

MP76. UNDERSTANDING COMPUTERS THROUGH OUR OWN VIDEO GAME

Leonidou Andreas, Theofanous Christos
The GC School of Careers, Nicosia, Cyprus

Since 1936, when the first computer was invented, the use of the only machine that can simply process and analyse data in a blink of an eye, has unbelievably increased; yet almost 100 years later, most people do not know how a computer REALLY works.
Most of us today, use a computer to communicate, share information, make calculations and myriad of other uses in our every-day life. Yet, have you ever wondered, what a computer understands when you type or when you scroll up and down the screen? Well, this is a great opportunity to finally learn more about one of the greatest inventions that have ever been made.
By researching through the development of the computer we will attempt to show you how software developers develop a programming code, how this code is then translated into binary numbers and finally how the computer processes the user input and gives the correct output. Utilizing our self-made mini video game, we will go through these concepts and demonstrate the steps followed from a "click" on the keyboard to the creation of a simple movement on the screen.
By the end of this presentation, you will have a good appreciation of the concepts of computational thinking, you will be able to understand arrays such as "01101001" and become more aware of the many computational aspects of our every-day life we are totally oblivious to!

MP77. MATHS IN YOUR FACE

Michalis Michaelides, Klitos Philippides, Christos Romanos
The GC School of Careers, Nicosia, Cyprus

While reading this text, we would kindly ask you to forget that you are reading an abstract and imagine that you are standing in front of a mirror. Tilt your head up, look directly towards your face and smile. This is the most precious, special and unique part of your body. What is it comprised of? What can it do? Which are your most beautiful characteristics? Why are they your most beautiful characteristics? And most importantly WHAT DOES MATHS HAVE TO DO WITH IT?

A face is not just a simple piece of nature, but an assemblance of numerous ratios, a generator of expressions and feelings which are solemnly relying on maths. Yes, the "positivity" of X^2 in the equation of your smile creates a happy expression; the gap between your eyes, your cheeks, your ears could be algebraically represented and analysed through maths to show different ratios and find if you are actually beautiful. Can we measure beauty though? The ancient Greek mathematicians decided to help us a bit by offering us the golden ratio, the divine equation of beauty. The golden ratio will be used extensively in our struggle to research if "beautiful faces" are mere aspects of personal perception or if there is more to that.

Maths does not only exist in your face, but continuously "transforms" it, offering us the opportunity to feel and express ourselves through mathematics. Well, maybe we all are one big mathematical expression. Let's decipher that together.

MP78. A MATHEMATICAL BIOGRAPHY OF THE PRICE OF LIGHT

Nikolas Markoullis
The GC School of Careers, Nicosia, Cyprus

We live in a fast-moving and science-progressive age for humanity. Truth be told the 21st century's hectic schedule can be difficult, nonetheless many times people take many modern necessities for granted, such as lighting at night. Switch off a light bulb for an hour and you are saving illumination that would have cost our ancestors all week to create. Would our 14th century ancestors really have anticipated our excessive stress at an age where light is obtained in the house by a single click and costs many thousand times less compared to the 1300s?

This presentation conducts "A Biography of The Price of Light" in the global language of science, which is no other than mathematics. To investigate how the price of light has evolved over the past seven centuries, this presentation uses time series and cross-sectional regression models. The statistical analysis carried out is multifaceted and focuses on how and at what price humans have been obtaining light through kerosene lamps and electricity and how this has evolved over time. We will see that the price of light does not show a uniform change and look into several events such as major wars that affected it.

Let this presentation make you understand the mathematics behind lightning and help you appreciate it once again. This is more important than ever before as something that was so precious to use has become too cheap to notice. Are you ready to receive the sparks of a numerical biography like no other?

MP79. A NOT SO SECRET TRIANGLE FULL OF SECRETS

Andreas Aloneftis, Theodoulos Ttelias, Sotiris Xiouros, Stephanos Zorpas
The GC School of Careers, Nicosia, Cyprus

What is it? Is it a triangle? Is it just a bunch of numbers? One thing is sure, it is fascinating! Join us in this journey to unlock its secrets! Let's find out how it was brought to life by many of our ancestors. Let's discover its uses and be blown away by its application in the world of mathematics.
When we first started working on this presentation, we really wanted to find out what it is about Pascal's Triangle that has so intrigued mathematicians all over the world. What we found out astounded us. This entity, built by trivial addition, is full of patterns and sequences. First and foremost, there's the simple methodology that generates it. Then there are the coefficients of the binomial expansion, the successive powers of two, many geometric applications like the triangular numbers, the Sierpinski Triangle and many more. In our presentation we will analyze some of those patterns and their application in mathematics, giving emphasis on how this triangle simplifies our calculations.
The patterns in the Pascal's Triangle are a testament to the elegantly interwoven fabric of mathematics in the universe. It is still revealing its secrets to us even to this day. What might we find next? Well it is up to us, the future mathematicians. One thing's for sure though. The Pascal's triangle is the most genius, and at the same time mysterious, triangle of all.

MP80. BEYOND THE BORDER

Rolandi Theodora, Yiallouri Panagiota, Yiorkadji Mary
The GC School of Careers, Nicosia, Cyprus

We dare ask: Isn't it rational that during a war nobody has time for Mathematics? After all, a war is a question of politics and diplomacy and Mathematics has no place in that. However, this presentation will prove with mathematical accuracy that Mathematics not only survived as a science two World Wars, but also played an integral part in both wars. The two World Wars challenged Mathematicians to such extents that they developed new theories and techniques, attacking conventional views on Mathematics. Mathematicians' contributions managed to put an end to the Second World War's suffering approximately 2 years earlier than what it would normally have.
History is a process of continuity and Mathematics is an applied science. When these two fields come together, life-changing developments occur. Political philosopher Edmund Burke stated that "Those who do not know History are destined to repeat it". Yet, allow us to extend that by saying "Those who do not know the power of Mathematics are destined to suffer".
Mathematics is the past, the present and the future. Mathematics is all around us and we cannot deny its power. Who could have predicted the current world status quo had it not been for the breaking of the Enigma Code? We are living in a constantly changing and evolving world, in which Mathematics exerts a decisive influence.
Let us prove how Mathematics surpassed the border of science and shaped the society we currently live in through a journey of Mathematical developments during the two World Wars.

MP81. WOMEN COUNT: TIME FOR CHANGE

Marion Kokkinou
Kykkos A Lyceum, Nicosia, Cyprus

The underrepresentation of female mathematicians in the academic community seems to be a problem that spans countries. For instance, all 15 full professors at the Mathematics and Statistics Department of the University of Cyprus, which is the speaker's country of origin, are men. Following a review of recent literature, five commonly mentioned measures for helping tackle the problem were identified. However, these measures were suggested and/or implemented in other countries. Moreover, since financial resources are almost always limited, it is best for policy makers to be able to make informed decisions on which ones to choose. Thus, it was decided that the measures should be ranked according to their possible effectiveness in Cyprus, in order to help inform policy makers on which ones should be tried out first. In December 2019 an on-line survey was conducted via Google Forms with 20 female and 20 male teachers of Mathematics in Cyprus (Elementary and Secondary Education). Using a multiple-choice format, for each of the five suggestions the participants were asked to select one of the following responses: 1. "I don't believe it will be effective", 2. "I believe it might be somewhat effective", and 3. "I believe it will be quite effective". Based on the responses, the suggestions for measures were ranked as follow: 1. Scholarships to female Ph.D. students of Mathematics, 2. Promotion of positive role models, 3. Informational sessions with parents, 4. Campaign to fight stereotypes, 5. Teacher training. Further possibly effective measures suggested by the participants are also discussed.

MP82. HOW NOT TO GET AWAY WITH MURDER

Bobrova Lisa, Pastella Josephina, Prodromou Carolina
The Senior School, Nicosia, Cyprus

The presentation includes an in-depth analysis of Rossmo's formula. Rossmo's formula is a geographic profiling formula which predicts where the serial killer lives. The formula was developed and patented in 1996 by criminologist Kim Rossmo and was integrated into a specialized crime analysis software product called Rigel.
Our presentation is merely focused on one specific killer; Richard Chase. We present all his murders, including pictures and gruesome details. We then use information from these murders, to extract coordinates to be used in the formula. Furthermore, we include a psychological profile, where we discuss the signs and symptoms of Chase's disease and then present the formula. This includes an in-depth analysis of the formula and how it works, where we try to help the panel and audience comprehend the mathematics behind solving this murder. After this, we extract coordinates from the murders (location of murders) and then input it into the formula. We solve the formula on stage in order to make the presentation more interactive. Once the formula is solved, Chase's residency is revealed, thus confirming Mathematics can be used to solve murders.
Our aim is to captivate the audience with this ground-breaking mathematical formula. The interesting concept helps the audience understand that mathematics can be used to uncover evidence and solve cases.

MP83. TICKETS AND BOXES

Kaloyan Todorov Fachikov
Sofia High School of Mathematics "Paisii Hilendarski", Sofia, Bulgaria

My project considers one combinatorial problem. Its main idea is to spread several tickets into some boxes. Each object has a designated code. There is a specific way, depending on their code, in which some tickets are related to some boxes. The aim is to cover all the tickets by choosing the least number of boxes in a way where the chosen boxes and all tickets have relations. Firstly, I solve several particular cases of the problem which show me different approaches of the topic. One of them involves Graph Theory. This mathematical field is very widely spread in problems which search extremums. Specifically, in our case, Turán's theorem is very helpful to solve them easily. Secondly, I generalize it by extending the codes into arbitrary number bases. Finally, I examine the problem in its most general case and make an analysis of some of its properties. For example, Graph Theory combined with Probabilistic Method, as the Asymmetric Lovász Local Lemma applied for a graph with the objects as verticies, could give me a bound for the general case.

MP84. THIRD DEGREE EQUATIONS

Afonso Domingues, Tomás Lôbo Campinos
Lycée Français Charles Lepierre, Lisbon

Firstly we are going to present third degree equations and their multiple forms. We will start by presenting the standard form (ax3 + bx2 + cx + d = 0) and we will give examples of these. Then we will present the shape of third degree functions by showing in our PowerPoint presentation some graphs of these functions. Afterwards we are going to introduce the factored form (a(x-x1)(x-x2)(x-x3)) and prove that this corresponds to a third degree equation. Using the factored form it becomes easier to create a sign table which we will draw. Next we will quickly go through the canonical form (x3 + Px + Q = 0) without detailing too much. Secondly we will show how to calculate the roots of a cubic equation in three various methods: by using the factored form, by factoring a standard form and lastly by using the derivative and the discriminant of the derivative. This will enable us to create a sign table and consequently a variation table to solve the cubic equation. Finally we will end our presentation by performing a two-question interactive quiz with the audience.

MP85. A “BEAUTIFUL MIND” FOR THE CYPRUS PROBLEM

Cosma Emelia, Koulermos Isabella, Skordi Iliana
The Senior School, Nicosia, Cyprus

Life is a mathematical equation. In order to gain the most out of it, one must know how to convert negatives to positives. This is true, even though we are not always able to recognize the application of mathematical reasoning and rationale every time we encounter them. Politics is life, playing a key role in establishing peace and collaboration within and between nations by establishing rules, regulations and setting standards for expected codes of conduct.
In an effort to justify this argument we have decided to focus on a mathematical economic theory- the Game Theory and the Equilibrium theory of a beautiful mind, Dr. John Nash - and attempt to demonstrate how it can explain why our own city remains the last divided city of Europe, why the Cyprus problem remains unsolved for so many years.
More than 50 years of inter-communal negotiations have passed. Our presentation will attempt to explain that in this conflict the two sides (Greek Cypriot and Turkish Cypriot) have been playing a “Prisoner’s Dilemma” game. We will explain why the status quo is a “Nash Equilibrium” state, being the outcome of a “no regrets” strategy from both communities.
Can Game Theory and the Nash Equilibrium, which have been extensively used as decision making tools during the Cold War, explain the political behavior and decision making of fifty years of inter-communal negotiations in Cyprus? Can it forecast how and when negatives can be converted to positives, enabling both players in this political game to gain the most?

MP86. MATHEMATICS IN SPORTS

Felous Filippos, Sapounaki Stella, Stamou Athanasios-Nikolaos, Tsagiannis Georgios
The American College of Greece-Pierce, Athens, Greece

Mathematics can be thought of as something with undoubted usefulness in our everyday lives. Various applications for it are easily found by someone who is willing to spend a little bit of his time. One aspect in which it can turn out to be extremely helpful is sports. To be more specific, athletes who are interested in basketball, soccer, tennis or sailing could find it beneficial having the appropriate knowledge of the specific scientific field. The purpose of the paper presented here is to uncover the secret mathematical skills that someone should have in order for him /her to achieve his /her goals and succeed in his /her athletic activity. All of the above can be easily learnt through the educational system, and most importantly school, and further expansion of knowledge is always an option. Consequently, after the specific research, a clear image will be drawn into the relationship between mathematics and sports.

MP87. HOW TO WIN AT SUDOKU

Kalleas Spyros, Katsareas Ilias, Mavrias Konstantinos, Peppes George, Politis Sotiris
The American College of Greece-Pierce, Athens, Greece

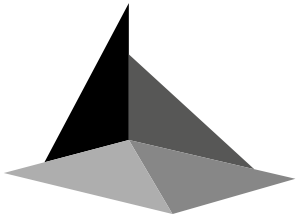
A Sudoku is a combinatorial number-placement puzzle where the objective is to fill a 9×9 grid with digits so that each column, each row, and each of the nine 3×3 sub-grids that compose the entire grid contains all the digits from 1 to 9. The puzzle provides a partially completed grid, and the goal is to extend this to the full grid. Sudoku puzzles and their variations have become very popular in recent years and they vary in difficulty from simple to devious. Puzzles have a unique solution that can be arrived at using pure logic. No guessing is required although complex strategies must be utilized in order to solve the hardest puzzles. In this paper we will examine some of the most popular strategies utilized in order to successfully complete a Sudoku puzzle, offering also examples for each case. We will also discuss the benefits of Sudoku to the mental health of individuals who play and try to complete Sudoku puzzles.

MP88. THE COMMON PROPERTY OF TRIANGLES 2-3-4 AND 3-4-5

Artur Kashnikov
Tartu Annelinna Gymnasium, Tartu, Estonia

The right triangle 3-4-5 is one of the most famous triangles. The lengths of its sides are consecutive integers and 3-4-5 is the smallest “Pythagorean Triple”. The triangle 2-3-4 is the obtuse one that also has consecutive integer sides. However, this is not the only common property for these triangles. The author will present another interesting property.
Let's consider four congruent right triangles (for example 3-4-5). It is possible to choose exactly one angle from each of them (namely the right angle from each triangle), so that all the chosen angles add up to 360 degrees? Is it possible to do the same using four congruent non-right triangles?

During his presentation, the author will prove that non-right triangle (a,b,c), where $a < b < c$, has the described property if and only if the lengths of its sides satisfy the equality $a^2 + bc = c^2$. Moreover, the smallest such triple of integers is 2-3-4. It means that when using angles of four congruent triangles 2-3-4, one can make up a full rotation around their common vertex.



Also, the author will present that there exist infinitely many triples of positive integers (a,b,c) that satisfy the equality $a^2 + bc = c^2$. For every integer $n \geq 2$, one can choose values

$$a = n, \quad b = n^2 - 1 \quad \text{and} \quad c = n^2$$

for which the equality is true. It means that triangles 2-3-4, 3-8-9, 4-15-16 and so on have the described property.

MP89. AN INTRODUCTION TO COMBINATORICS

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In this paper we study Combinatorics, a very interesting and useful field of Mathematics, concerned with the evaluation of the number of elements of a set. This paper deals, initially, with the basic concepts of the Combinatorics, i.e., the Rule of Sum or Addition Principle, the Counting Principle and the Bijective Proof. Furthermore, we study the permutations and combinations of n things taken k at a time. Combinatorics is a fundamental area of Mathematics since it applies to many areas of Mathematics and Sciences, for instance to Graph Theory, Computer Science and Biology.

MP90. MATHEMATICS AND NATURAL SELECTION

Markou Anna, Christou Panos, Christou Adamos
Theoretical Mathematics and Physics route at The Archbishop Makarios III Lyceum, Ktima, Paphos, Cyprus

Natural selection has been an important quality of evolutionary theory. According to the theory of evolution through natural selection, when beneficial mutations appear, they should advance throughout a population, but this isn't always the case. Most of the time, random events occur that erase beneficial mutations when they are new and rare. However mutations should have a higher chance of survival in some situations than others. The ability to use mathematical models to present natural selection could help pin point the situations in which beneficial mutations would have a higher chance of spreading throughout the whole of their population. In our presentation we define graph theory and explain some of its basic terminology. We also define natural selection and some of its basic terms. Lastly, we will show how we could simulate natural selection with graphs.

MP91. ETHNOMATHEMATICS

Panagiota Papakyriakou
The Grammar School, Nicosia, Cyprus

Mathematics is the abstract science of number, quantity, and space, either as abstract concepts or as applied to other disciplines. However, the term ethnomathematics is used to express the relationship between culture and mathematics. The goal of ethnomathematics is to contribute to both the understanding of culture and mathematics and to lead to an appreciation of the connection between the two. Ethnomathematics has been a concept that has been bothering mathematicians for years now, since it is believed that ethnomathematics can be used to help students understand the different mathematical concepts easier in a more effective way. In this presentation, different examples of ethnomathematics will be presented. For instance, the naming of numbers across different countries as well as mathematics in skill games will be explained. Finally, it will be highlighted why ethnomathematics can be beneficial for students. Ethnomathematics can help students understand mathematical concepts easier and better but also it can help them understand their culture better. It is proven that ethnomathematics can help students accept and celebrate different cultures across the world. To add to this, ethnomathematics seem to help students think 'outside the box', since they are exposed to many different lines of thinking. To conclude, ethnomathematics is a concept that should be worldwide known and that is because it combines two of the main concepts of our world: culture and mathematics.

MP92. FIBONACCI SEQUENCE

Constantinos-Laertis Andrianos
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In mathematics, the Fibonacci numbers, form a sequence called the Fibonacci sequence. The Fibonacci Sequence is a series of numbers in which each number is found by adding up the two numbers before it starting from 0 and 1. Fibonacci numbers are named after an Italian mathematician, Leonardo Pisano Bigollo, later known as Fibonacci. He introduced the sequence to Western European mathematics, however the sequence itself was known earlier for hundreds of years before that, probably because of its many interesting properties that make it useful in many areas of life, from mathematics to computing. It is an example of a complete sequence which means that any integer greater than 0 is written as the sum of Fibonacci numbers without using any term more than once. It also shares a lot of similarities with the well-known golden ratio, φ, which is found practically everywhere, from nature to architecture. When squares are made with their widths being successive terms of the sequence, we get the golden spiral. When a term in the sequence is compared to the term before it, a number close to the golden ratio is found. The larger the numbers, the closer their ratio is to the golden ratio. Even if we take two random numbers and use them as the beginning of the sequence, the same thing happens, although it takes more time to get a value closer to the golden ratio. The sequence also works for numbers below zero.

MP93. MATHEMATICS BEHIND THE GREAT PYRAMID

Christiana Katsarou, Eloise Charalambous,Eva Assiotou
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Imagine a time with no advanced machinery, when there were no cranes or hoist. It was during this time the Egyptians created the Great Pyramid of Giza (pyramid) with stones that weigh about 5-10 tones each. Despite being one of the oldest and largest monuments on Earth, there is no consensus about how the Great Pyramid of Giza was built. The questions still arise today and there is no one to answer with certainty, how the huge stones were carried those days where there wasn't supposedly any advanced technology and machinery. How did the ancient Egyptians create such a mathematically precise structure? There are multiple theories however, with incredible details that suggest that the Great Pyramid of Giza was an immense mathematical, architectural and engineering project, one that our civilization today, would have a hard time replicating. If the ancient Egyptians weren't advanced how would they know that by adding the right amount of water to the limestone and granite rocks friction would be reduced and it would be easier to carry the rocks? Although the position of North Pole moves over time the Great Pyramid of Giza was exactly aligned at one time making it the most accurately aligned structure facing true north with only 3/60th of a degree of error. The Great Pyramid of Giza shows many mathematical theories, trigonometric and geometric ratios we use today which makes us believe that the ancient Egyptians new many things before us.

MP94. USING MATHS TO SOLVE RUBIK'S CUBE

Iosif Elia
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In 1974, 30-year-old Ernő Rubik was a professor of architecture in Hungary when he had the idea of constructing a handheld puzzle game based on geometry that could help students understand spatial relations. The first prototypes made of wood blocks and paper clips were encouraging; pairing with a toymaker in Hungary, Rubik saw his original Magic Cube get modest distribution. In 1980, when the Cube was licensed by Ideal Toy Company, developers changed the name to Rubik's Cube; they felt "Magic Cube" invoked ideas about witchcraft. Rubik's cube is inherently very mathematical. It's got algebraic structures. There are different types of Rubik's cubes, ranging from 2x2 to 33x33. With six sides representing nine blocks of a single color - orange, yellow, green, red, white, and blue - a Rubik's is said to hold 43.25 quintillion potential configurations. That's 43,252,003,274,489,856,000 possible ways. We calculate this number like this: (12! x 211 x 8! x 37) ÷ 2. If you cycle through one combination every second, you would try all of them after 1.37 trillion years – almost exactly 100 times the age of the universe. Rubik's cube is solved with algorithms.

MP95. BENFORD'S LAW AND ITS ECONOMIC APPLICATIONS

Elisavet Aifanti
Varvakeio Pilot High School of Athens, Greece

The purpose of this study is to describe Benford's Law, to research its application in logarithmic data and to validate its utility through experimental use. In particular, the mathematical nature surrounding Benford's Law will be examined, with the purpose of using Hill's Theorem of random variables to justify the scale-invariance and base-invariance that characterize numerical data that follow Benford's Law. Furthermore, real-world applications of Benford's Law will be researched, such as in population statistics and in scientific and environmental data. An emphasis will be given on its economic applications, such as the detection of financial fraud and manipulation in economic forecasting.

MP96. DAY IN, DAY OUT

Andrej Bozic, Luka Kirincic, Luka Zmak
Prva rijecka hrvatska gimnazija, Rijeka, Croatia

Mathematics is not always simple. When you were young you must have struggled to solve some task and you asked yourself why you had to learn this and would you ever need that in real life. The answer is not very complicated: maths is all around us and to have a better understanding of the world, we need to understand math. It doesn't help us only in specific situations, but in our everyday life. It helps us to precisely analyse the circumstances and make correct decisions based on that information. At first glance it doesn't seem that way but subconsciously we constantly use mathematical knowledge and its laws in different situations. We will guide you through an imaginary day and emphasize the role of mathematics using real life activities. Math will give you a new perspective of the world and it will prove that for successful decision making you need logic and not luck.

MP97. MATHEMATICS IN BOHEMIAN RHAPSODY

Lucijan Mofardin
Prva rijecka hrvatska gimnazija, Rijeka, Croatia

Mathematics, as a rational science, is considered unmatchable with music, which has a substantial role in a common man’s life. We are constantly surrounded with music but mathematics as well. Ancient Greeks considered music as a pure mathematical discipline which was a science of sound and harmony.
The main goal of my research and work is to prove that Bohemian Rhapsody, as a composition, has a unique structure which is directly linked to mathematics. The objective is to present and prove how a musical act is indeed a complex mathematical work. The inspiration and harmony which Freddie Mercury had instinctively felt is of critical importance to creating a piece of art like that. To prove my point, I will present the song with functions (graphically) and, by applying the Fourier transform, show at which frequencies, mainly chords and tones the harmony appears. By doing the analysis on an esthetical level, I will confirm the metaphorical connection between music and mathematics that is based on the process and analogy of creating music. With the analysis I will demonstrate the link in terms of: frequencies, resonances, vibration and mechanical features. While doing this research it will become evident how a rhythm begins to appear. I will explain the forms in the song by following the structures in the composition which interweave mutually and connect so that the melody inspires and communicates with us.
From this it can be concluded that the process of composing can be compared with solving mathematical problems.

MP98. MATHS AND CRIMINOLOGY

Kristia Kouppi, Athina Panayidou, Constantina Stefani, Eliana Gabrielides, Nguyen Ly Thuy Linh, Antigoni Ioannides, Ellie Mountoukou
Pascal English School, Lemesos, Cyprus

Math is applicable to Criminal Justice in the same way butter is lathered on bread. As in the crime scene examples, only math could be used to distinguish between an animal hair and a human hair, that could determine if someone was at the crime scene or not-a human hair sample could lead investigators to a potential suspect, otherwise unknown. Talk about tying up loose ends, we think math could do that, too. Many mathematical subjects are used in a crime scene. Trigonometry, the measurement of triangles, is used in the analysis of blood spatter. Ballistics calculations, such as computing the ricochet angle and of a bullet bouncing off a solid surface, use trigonometry. The exponential and logarithmic functions play a key role in forensics. The exponential function relates to processes that depend on the amount of material present as time changes. Rates of heating or cooling, or of the metabolising of alcohol and drugs, are governed by exponential rates of change. For quantities that vary over many orders of magnitude, such as the concentration of chemicals in the body, the logarithmic function allows us compress them into a more manageable range. Moreover, quantitative statistical analysis is used to compare sets of experimental measurements to determine whether they are similar or distinct. When analysing evidence from fingerprints,blood groups and DNA profiles, probability enters the scene. In the hands of forensic scientists, every piece of mathematics we learn in school may prove to be a matter of life or death.

MP99. MATHEMATICS BEHIND THE IN ASPENDOS ANCIENT THEATRE ARCHITECTURE

Ensar Abdullah Demirbilek, Talha Yunus Demirbilek
Ülkü Ortaokulu, Isparta Turkey

The ancient city of Aspendos is located in Southern Turkey, in the ancient Pamphylia region by the Eurymedon (Koprucay) river. The site of Aspendos houses one of the best preserved ancient theatre of the world. Roman theatre in Aspendos one of the great structures built on a hill slope according to the Greek tradition. The audiences' seats are semi-circular. They cut by horizontal walkaway separating upper and lower sections audiences' seating. Theater has twenty-one columns of seats above and twenty lines underneath as rich situated beneath and poor above-order.
The capacity of the Aspendos is about 15 000 people. Audiences can to hear unamplified sounds from the stage at even the back row. What are the mathematics and science behind the perfect sound of performer on the open-air stage which can be heard in the back rows? The purpose of this study is to explore the reasons behind why an audience can hear the sound of performer from the back row of the Aspendos Ancient Theater. On this research, we will explore mathematical model of the Aspendos Theater and acoustic futures of its architecture.

MP100. INFINITY

Enzo Caldas, Martim Carvalho, Guilherme Terça
Lycée Français Charles Lepierre, Lisbon

In this presentation, we will show you how counterintuitive infinity might be. Although it may seem like there's not much to it, the endless and unimaginably big has a lot to teach us. What is it? how does it work? Can we play with it? What are the different sizes? These are just some of the questions we will be pleased to answer.
In a nutshell, we are going to compare different kinds of infinities, namely: the set of natural numbers with the set of rational numbers, the set of natural numbers with the set of real numbers and the set of real numbers with the set of complex numbers. Then, we will explain how to create bigger and bigger infinities (using the power set). In this step, a new notation will also be introduced: aleph null. The presentation will finally end with one or two funny little infinity paradoxes.

MP102. APPLIED INTEGRATION: TAKING TOTAL IMPULSE OF THRUST-TIME CURVES FROM ACTUAL SOLID ROCKET MOTORS

Harry Amadeo
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As a rocket motor proceeds through the course of its burn, propellant is combusted and expelled through the nozzle, which in turn generates thrust as per Newton's third law. A useful value derived from the thrust curve—a graph where thrust is plotted on the y-axis and time is on the x-axis—that the motor generates is the total impulse, which is the area under the thrust curve. It is defined as the total momentum the motor will impart on the rocket over the course of its burn. Knowing this value will help to determine the maximum altitude that a rocket can reach.
Finding the total impulse of a thrust curve is not a completely exact process, however. It involves taking the integral of a curve that does not conform to well-known curves that are shown in the classroom, such as parabolas: the curve has bumps and irregularities. Thus, analytic methods of taking the integral cannot be employed, but rather numerical approximations. Two approximations are presented in this paper: the left-Riemann sum and the trapezoidal approximation. The goal is to demonstrate the usefulness of each method in determining accurate values of total impulse and to show a real-life application of calculus.

MP103. THE LOGIC BEHIND QUATERNIONS

Konstantinos Leontiadis, Odisseas Nikolaos Mpalis
Varvakeio Model High School of Athens, Greece

The subject of our presentation is Quaternions. Quaternions are four-dimensional numbers invented in 1843 by Sir William Rowan Hamilton. The first target of our project is to make an introduction to the idea of Quaternions and, generally, four-dimensions represented in our three-dimensional environment. We will also analyze both the real and the imaginary parts of Quaternions and explain the operations that happen between Quaternions using the special operations happening between the imaginary numbers.
Quaternions have been used in a number of fields of the Mathematics throughout the years. However, at the start of the 21st century, Quaternions entered and innovated the world of 3D animations. Those four-dimensional numbers were much superior to the other methods, such as the Euler angles, because the computer was able to detect and analyze every single point in the environment, by abusing the freedom offered by the fourth dimension. So in our project there will be mentioned the advantages of Quaternions in contrast to the Euler angles, mostly concetrating on the problem of the Gimbal lock. We will also do a Three-Dimensional representation of the movement using Quaternions and the same type of movement using Euler Angles, in a program made by using the Unity Game Engine, and demonstrate the capabilities of Quaternions.

MP104. DECODING MATHEMATICAL PATTERNS IN PLANTS

Talha Yunus Demirbilek, Ensar Abdullah Demirbilek
Ülkü Ortaokulu, Isparta Turkey

Math is everywhere. We use math to uncover the secrets of the universe and to see pieces ıf the nature that no one had ever seen before.
Scientists use math to understand and describe what happens in our world. However not only scientists use math but also everything in the universe is using math including plants. Plants make food from light. But they have also advanced skills. They have the ability to perform as mathematician. We may assume that plants grow in a random way. When we take a closer look to the plants, we will find out the hidden mathematical patterns on them in the nature. Sometimes the mathematical patterns are hidden on leafs, cones, flowers, and petals. Mathematics is already out there awaiting some to reveal it.
In this research we decode the mathematical patterns in plants and provide examples of these plants which has mathematical patterns. We will also explain how these mathematical patterns works.

MP105. TREE (3)

Elias Vadebo, Anton Lundqvist
Polhemskolan, Sweden

You probably know about some big numbers. Like for instance a googol, a number greater than the amount of atoms in the observable universe. How about a googolplex, a one followed by a googol zeros. Or maybe you have even heard of Graham's Number, a number so large that just trying to comprehend it would result in your brain collapsing into a black hole because from all the information being stored. What if I told you there is a number, greater than all of these. A number so big that it makes Graham's Number look like an infinitesimal. A number so big that even if Graham's Number amount of people split it up into equal parts and tried to comprehend their own part, they would all still collapse into black holes. A number called TREE (3). The most astounding part of this all is that this gargantuan number comes from a simple game of connecting dots called TREE. In this presentation we will be describing the origin of TREE (3) and its uses by explaining the game TREE. We will talk about the rules of the game TREE and how this seemingly simple game could generate such a massive number.

MP106. QUICC MATHS: A GUIDE TO IGCSE REVISION

Marios Stavrou, Ioannis Papazacharias, Andreas Constandinides, Kyriakos Hadjimichael, Zacharias Ioannou
The English School, Nicosia, Cyprus

Our project, Quicc Maths, aims to be a successful app, in helping students across the world revise their Maths iGCSE course. When users load up our game, they are treated with the Chapters from PEARSON 's student book. One simple click shows to any user, a video animation we have created that explains the concepts of the selected chapter. These videos are not just some boring scrolls of monologues that students in classes are always bored of. They are written in a fun, quirky and engaging way, to make learning an enjoyable and amusing experience to everyone. After the easy-to-understand video is finished, students can begin solving questions related to their selected chapter. We made sure that these questions are of varying difficulty, to ensure that the user is answering all possible types of questions that can pop-up in an exam. Through Quicc Maths we hope to create a feeling of joy when students revise their syllabus. More fun. Same quality of revision!

MP107. HISTORY OF MATH

Rosa Gustavo, Goual Adam
Lycée Francais Charles Lepierre, Lisbon

Our Euromath project talks is based on the history of Math in three different countries. We chose Egypt, Greece and China because they are the countries that have been using math for the longest time. And we found that their history is the most interesting.
To start with, the we will talk about how the Egyptians started using Math, their first symbols for numbers and fractions, how they did divisions and multiplications. And why they starting using mathematics.
In our second part we will focus on the history of chinese mathematics: the simple but efficient chinese numbering systems. Which consists in using small bamboos to represent numbers from one to nine.
And we will end with the history of Greek mathematics. It evolved very rapidly because greece was a very active country in wars. This way their mathematical system improved very efficiently after every conquest.
In conclusion, our EuroMath project is based in the study of mathematical history by taking for example the three most involved countries.

MP108. THE MATHS OF SPORTS OR AT LEAST OF SPORT BETTINGS

Botond Fehér
Turku International School, Turku, FINLAND

I think many of us, people on the Earth have tried sports betting at least once before. Some of us have won, some of us have lost our very first bets, some of us have kept on betting, some of us have never done it again. Did you know that there is a greater chance of keep on betting if you lose sometimes? When putting a wager on sports, we feel like we are gambling and that only luck defines whether we win or not. Although this statement is false. In sport-betting, mathematics plays a more significant role than we would think. Have you thought about what methods the bookmarks use when defining the odds? How does this system work? How can you beat the system?

MP109. THE EULER LINE

Daeira Naskari, Katerina Kyriakidi, Natalia Triantafyllou, Elena Alevropoulou
The Moraitis School, Athens, Greece

In this presentation, we discuss the Euler line. In every triangle, the orthocenter, the centroid and the circumcenter are collinear. Furthermore the distance between the orthocenter and the centroid is always double the distance between the centroid and the circumcenter. Another remarkable fact of the Euler line is that it passes through other notable points of a triangle, such as the center of the nine point circle, the de Longchamps point, the Schiffler point, the Exeter point and the Gossard perspector.
Euler, a Swiss mathematician, who at the time was working for Catherine the Great in St. Petersburg Academy, made accidentally his discovery while he was trying to solve another problem, which as it turned out was not as important. His paper was published in 1767. Euler was meant to add fascinating results even in fields of mathematics which were over-examined already for centuries, like Euclidean geometry.

MP110. THE MAGIC BEHIND THE NUMBER e

Konstantinos Koutoulidis, FoivosMilovanovic, Emmanuel Venios
The Moraitis School, Athens, Greece

Number e, also known as “Euler’s number”, is a mathematical constant. It is regarded as one of the five most important numbers in Mathematics, as illustrated in Euler’s identity, alongside with 0, 1, pi (the ratio of a circle’s circumference to its diameter) and i (the square root of minus one).
We examine the mystery behind the number e, its origins, both historically and mathematically, the mathematics where it appears and its applications. Our presentation analyses two main proofs of this number, by introducing the following concepts: limits, interest rate, infinite series, the binomial theorem, logarithms, the natural logarithm and exponential and logarithmic functions. Our goal is to explain something so complex, like “Euler’s number”, on a basic mathematical level. Its applications in the world of science and particularly in advanced mathematics are countless and that is what makes it unique.

MP111. COMPLEX NUMBERS AND THEIR IMPORTANCE IN EULER'S IDENTITY

Natalia Kokoromiti, Giorgos Kosmas, Stergios Birbilopoulos, Ariadni Pilioura
The Moraitis School, Athens, Greece

ei□ +1=0. "Simple to look at and yet incredibly profound, it comprises elegantly the five most important constants in mathematics", said late great physicist Richard Feynman about the equation above. Probably one of the most powerful and mind-boggling results in history, Euler's identity has been named after the man that proved it, Leonhard Euler, one of the most prolific mathematicians that ever lived. Euler's identity is "a special case of a foundational equation in complex arithmetic" and manages to unify multiple intersecting aspects of mathematics. Two irrational numbers and the most fundamental of the imaginary numbers combined with the two most "simplistic", but at the same time most imperative, whole numbers in the area of mathematics produce such an impressive outcome, that the identity is often referred to as Euler's pearl.
In our presentation we delve into challenging branches of modern mathematics, such as trigonometry and complex analysis (their history, functions and their representation in the Cartesian system), in an effort to follow the steps of one of the greatest minds of all time and prove this amazing formula.

MP112. CRYPTOGRAPHY USING MATHS

Joseph Modestos Modestou
International School of Paphos, Paphos, Cyprus

Information is one of the biggest resources in the world and in the wrong hands can cause a lot of damage in indirect manners. That is why it needs to be hidden and only accessible by the people meant for it. Weather it is stored information or communications. For example bank transactions. If those messages were to be intercepted and leaked then a lot of money can be stolen as a case where a bank network was broken into by the infamous Albert Gonzales and over 14 million debit card numbers were stolen. This is where cryptography comes in. It is used to change information in such a way that it becomes unreadable and only readable by the person with the correct key. When it comes to encrypting stored information, it is simple as you have one key, encrypt it all and then keep the key hidden. It gets more difficult when it comes to encrypting live data transmissions. An example is you want to send an encrypted message to a friend so you send them the key used to encrypt the information so they can decrypt it. But when you send it another person gets the key which defeats the whole purpose of the secrecy. of course this can be done properly with the use of math and manipulating numbers in a controlled way. One of the biggest challenges to come is when the quantum computer is invented. This will break every form of information security we have today and a whole new system will need to be developed.

MP113. PROBABILITY

Dina Novikova, Jessica Vikersjo, Daria Kyrylova, Olga Machowska
International School of Paphos, Paphos, Cyprus

Probability is everywhere. Our presentation will include how probability can be applied in numerous real life circumstances such as the weather forecast, sports strategies, planning your insurance and much more. Probability is also vital in, for example, analyzing the various possibilities in the modern day business world. Investing is one illustration of this. Stepping aside from the business aspect, probability is also present in most games and recreational activities. Board games may include dice or spinners which determine the route of the game. Both dices and spinners involve probability, as there are different outcomes.
In our presentation we will also mention how to calculate probability as a percentage, decimal or a fraction. You can express probability in all of these ways, however, is most frequently displayed as a percentage. We will also discuss how display different outcomes in tables or tree diagrams, which actively illustrate the different routes in a certain situation.
Furthermore, we will expand on the fact that probability can be unfair or biased. Spinners with sections prevailing in size from others do not have equal outcomes, hence are biased.
In order to fully convey probability and its many aspects, we will be showing practical examples by using props. We will incorporate a game board spinner, which will oppose a homemade spinner to compare the outcomes of a fair and unfair spinner. In addition, we will toss different forms of dice to show that the more outcomes, the less chance there is for landing on a specific digit.

MP114. WHAT YOU'LL FIND IN HIGHER DIMENSIONS

Tiana Taliotou, Kiriakh Hadjipanayiotou, Anna Maria Hadjipanayiotou, Andreas Hadjitofis, Solwnas Konstantinou
Theoretical Mathematics and Physics route at The Archbishop Makarios III Lyceum, Ktima, Paphos, Cyprus

Through this project , we are showcasing one of the most outstanding fields of mathematics , topology . Only recently recognized , yet having its routes in the very first years of mathematical research . A topic studied by many incredible mathematicians , such as Leonhard Euler and Johann Benedict Listing , yet hardly considered until today … the day we have the ability to resemble what we can't see through the technological sources available to us … the day where 4,5 and 256 dimensions can be visualized to a species with the capability to only view 3 . That is why we chose to present topology , and specifically geometric topology , of all the topics surrounding the field of mathematics available to us . It's a branch of an incredible science in it's self , that allows us to study the up to now impossible . The ability to explore dimensions and forms beyond those that our brain can process . In the past , it never got the recognition that many other topics did , purely because of the lack of resources to allow for such an innovative and forward thinking science to excel . Now a days , we have the capability to advance a topic that could very well be lifechanging . After all , what would life be like with more than three dimensions ?

MP115. CLIMATE CHANGE CONTROL THROUGH GAME THEORY

Economou Kyriaki, Kyriacou Semeli, Christodoulou Eleftheria
Lyceum A' Ethnarchis Makarios III Pafos, Cyprus

It is an undeniable fact that multiple natural disasters and change in climate have led people to speculate that we are in the beginning of a mass extinction. Most people as well as countries, well aware of the problem surrounding them are in a troubling dilemma. Will my actions help the situation get better? Will I waste my time and effort and not make a difference? How can I know? How can I predict the outcome of my actions? Could the game theory help us decide whether our actions will have an impact in climate change? The game theory is the mathematical study of interaction between individuals, groups, animals, businesses, or countries. Discovered in the late 50s, this theory has helped to improve several fields. But how can this well-structured theory predict how people and countries will behave towards environmental change and discover ways to tackle this issue? Game theory and its strategies can find solutions to this infamous problem. Certainly, addressing and tackling this issue has been very controversial in the past with people being deep in denial about the subject and others doings their best to prevent it. Besides, believing what's best for yourself does not mean believing what's best for society. Join us in discovering how we can associate the game theory with climate change and its effects.

MP116. ETHNOMATHEMATICS

Ismini Anagnostou, Stella Dimitriou, Danai Fragki, Sophia Gkourogianni, Alexia Zafeiriou
Supervisors: Lina Chachali, Eirini Siotou
Nea Genia Ziridis, Greece

What is the relationship between mathematics and culture? Do all human civilizations share the same view about Mathematics? Are mathematics culture-free? In our research we try to give answers to these questions. We will present the main approaches on this subject and argue about whether cultural values can affect the teaching, learning and curriculum. We will present different approaches on subjects like multiplication or the Pythagorean theorem. Despite the universality of concepts such as counting, ordering and sorting there are researches who present radically different ways of approaching them. Last but not least we will examine the fundamental question about the nature of mathematics and whether humans discover or invent them.

MP117. DESIGN AND CONSTRUCTION OF 3D PRINTER

Romanos Gkougkoulias
Supervisors: Lina Chachali, Eirini Siotou
Nea Genia Ziridis, Greece

The paper pertains to the design, construction and assembly of a cartesian 3d printer with high performance, but with low cost so that every student can benefit from the advantages of 3d printing.
The paper focuses on the use of applied mathematics required for the operation of the printer and in particular:
a) PID algorithm, which is necessary in many robotic applications (such as in drones and segbots – for the maintenance of equilibrium, in the 3d printer for achieving with great accuracy the required temperature in the Hot End and in the Hot Bed and in order to maintain this temperature stable.
b) The use of the Cartesian co-ordinates for the three dimensional printing and in order to know the exact position of the Hot End in the system.
The features of the Cartesian printers, such as this specific one, are analyzed. The blueprints for the construction are included as well as the bill of quantities.
The mechanical problems that need to be addressed are also analyzed as well as potential errors and technical mistakes that might occur during construction, assembly, and operation, as well as possible solutions (such as use of bumpers, and high accuracy measurements with digital caliper.

MP118. CRACKING A LOCK USING MATHS

Natalia Eleftheriou, Despina Vasiliou
The Senior School, Nicosia, Cyprus

Our presentation is about cracking a 4-digit lock and the Maths hidden behind doing so. There are several ways to pick a lock, but there are only a few that you can actually apply in real life. Using a specific type of sequence called De Bruijn sequence named after the Dutch mathematician Nicolaos Govert De Bruijn, who wrote about it in 1946, we will illustrate how someone can pick a lock by applying Mathematics. With this sequence, you can identify all possible combinations from 0-9 in a 4-digit lock. By use of Maths throughout graphs, sequences and equations, one can learn the hidden Mathematics behind this theorem and is able to apply its principles in everyday life.

MP119. HEXAPAWN – A GAME THAT LEARNS

Eva Deftera, Sotiris Efstathiou
The Senior School, Nicosia, Cyprus

Mathematics are everywhere around us but has anyone told you that there is math in artificial intelligence? Artificial intelligence is all about enhancing computers' knowledge. Hexapawn is a game that enhances your knowledge as it changes the way the computer reacts, depending upon human input. Hexapawn is a mathematically oriented game that plays a trick on the mind and puts it to work hard in thinking as well as to play in a strategic but also in a smart but in an intelligent way. It's played on a 3x3 grid and the computer evolves as it plays the game. Moves that result in a loss are never repeated by the computer as the human gives his feedback to the computer. It is said that this game can make your IQ (intelligence quotient) as well as your mathematic skills improve immensely. Suitable for all ages if you have a passion or a desire to challenge your skills.
Dare to enhance your mathematical capabilities!

MP120. WHAT MAKES US SPEND MORE IN SUPERMARKETS, AND FEEL GOOD WHILE DOING IT

Mehmet Derin Ozser
The Senior School, Nicosia, Cyprus

Have you ever wondered why products in a Retail Store are placed in a certain manner? Supermarket product placement is a game within itself. What seems like a harmless trip to the grocery store turns into a labyrinth of fresh products and other necessary goods. A company's product displays, and layout strategy can have a powerful influence on a consumer's decision of whether to purchase a product or not. In-store product placement can be optimized through planning, negotiation, and design to maximize revenues. Optimization is the process of finding the best solution to a problem. We basically take a real-world problem, model it mathematically and solve it by using mathematical techniques. In this presentation I will explain how we can use mathematical concepts and modelling to optimize placement of retail products on shelves in order to maximize sales.

MP121. INFINITY CAN VARY

Dasia Razumova
The Senior School, Nicosia, Cyprus

Most of us heard the term "infinity". We all imagine it in some way. Infinity represents something that is boundless or endless or else something that is larger than any real or natural number. However, did you know that one infinity can be larger than another? To be more precise there exists a variety of infinities and some are simply larger than others. In 1891, George Cantor published a paper containing his "diagonal argument" for the existence of an uncountable set and proved what is now known as Cantor's theorem. The theorem states that, for any set A, the set of all subsets of A has a strictly greater cardinality than A itself. In my presentation I will explain that there are more real numbers packed in between zero and one than there are numbers in the entire range of naturals.

MP122. MATH IN OUR LIFE

Vasilis Papaioannou
IE' Agios Neophytos school- Kato Polemidia, Cyprus

Math is everywhere in our life. From our breakfast to the longest river in the world. We use math in music, time, food, health, language, geography. We count money, lines and syllables. Also, we count kilograms or kilos and minutes or hours. We measure the height, the length and the depth. Math is in medicine, in food and in history. Finally, math is so important and we use it in daily life to solve easy and difficult problems.

MP123. PYTHAGORAS

Alexandros Papageorgiou, Polydoros Sotiriou
Lyceum A' Ethnarchis Makarios III Pafos, Cyprus

Pythagoras of Samos was an ancient Ionian Greek philosopher and the eponymous founder of Pythagoreanism. He was born in 570 BC and died 495 BC.
His political and religious teachings were well known in Magna Graecia and influenced the philosophies of Plato, Aristotle, and, through them, Western philosophy. In antiquity, Pythagoras was credited with many mathematical and scientific discoveries, including the Pythagorean theorem, Pythagorean tuning, the five regular solids, the Theory of Proportions, the sphericity of the Earth, and the identity of the morning and evening stars as the planet Venus.
Pythagoras influenced Plato, whose dialogues exhibit Pythagorean teachings. Pythagorean ideas on mathematical perfection also impacted ancient Greek art. Pythagoras continued to be regarded as a great philosopher throughout the Middle Ages and his philosophy had a major impact on scientists such as Nicolaus Copernicus, Johannes Kepler, and Isaac Newton.
Many mathematical and scientific discoveries were attributed to Pythagoras, including his famous theorem. Since at least the first century BC, Pythagoras has commonly been given credit for discovering the Pythagorean theorem, a theorem in geometry that states that "in a right-angled triangle the square of the hypotenuse is equal [to the sum of] the squares of the two other sides". The Babylonians understood this 1000 years earlier, but Pythagoras proved it.

MP124. THE ANATOMY OF COLOUR

Linnea Kärrman, Oskar Vågsäter
Polhemskolan, Sweden

Would it be possible to express any given colour as a single value? Can our visible spectrum of colours be expressed as an integral?
By interpreting a colour as a combination of wavelengths, it can be represented as dot in a hilbert space. We will show how every color, visible or not, can be expressed this way, as well as explain the usage of hilbert planes to map colours our eyes cannot perceive. From gamuts to mantis shrimps, we will guide you through everything you need to know about colours from a mathematical point of view.

MP125. MATH DETECTIVE

Alexander Angeli, Giorgia Guarnieri, Dino Marinelli, Valentina Mocatti, Elena Pangrazzi, Giulia Parma Zappini, Anastasia Timis, Maria Chiara Vicentini, Marzia Zanon
Mentorw: Loredana Dell'Eva, Maurizio Marinelli
Via Taddei de Mauris, 4 38027 Malé (Tn), Italy

This project was born at the end of 2018 from the idea of looking for Math in the nature, in the architecture, in the art and in the landscape that sorround us. The purpose of the project was to prove that Math is everywhere.
The themes of interest are:

- Applications of mathematics
- Mathematics and sciences
- Mathematics and space
- geometry
- Mathematics and nature
- Communication of mathematics
- Mathematics and society
- Mathematics and computer science

During the last school year we took lots of photographs in our territory trying to identify the geometrical forms around us. Then we created a database of photos and math.
During this year, with the material that we collected, we elaborated a website to relate the photographs to math. The focus is on the mathematical approach. We highlight the major properties of the figures, the formula to calculate the area and the proof which brought to that formula.
In this conference we want to illustrate our work, give the proof of the area formula of some polygons, enunciate the major properties of the polygons and demostrate that math is all around us in man contructions and in the nature.

STUDENT PRESENTATIONS IN SCIENCE

SP1. PHYSICS IN CARTOONS

Nikita Guz, Dohyun Lee
International School of Moscow, Russia

The physics in cartoons can be very different to that of real life. Those who find themselves as cartoon characters may or may not survive if they do not know the local laws. Basic real-life concepts, such as: gravity, air pressure or even friction may not act in the cartoon realm the same as they do on earth. From the great falls of the coyote to the great pains of Tom, the special effects of cartoons are worth examining.
These revised laws affect the outcomes of numerous cartoons, and most of the time restrict the villain from coming out on top. Some popular examples such as Garfield or Looney Tunes use them in almost every scene, and try to make them comedic and appealing to a young audience.
Nevertheless, the laws of physics are not completely broken in cartoons. They used not to follow a general pattern. Back in 1980, a man by the name of O'Donnell created the laws of cartoon motion, which were published in a magazine and spread over most of the cartoons that we know today. Keep in mind that perspectives of comical physics may vary across different animators and different cartoons, but very rarely within the same cartoon. During our presentation, we will explain these features in depth and exploit many of the differences with real life scenarios.
Join us as we explain these cartoon physics phenomena, such as: walking through walls, or even propelling yourself with a fart. Let us explore the mathematical and scientific perspectives of the physics used in cartoons.

SP2. BLACK HOLES AND HOW THEY ROTATE

Amira Sembieva
International School of Moscow, Russia

Do you know much about black holes? For my presentation I will be talking about black holes and how they rotate. This presentation will start with how black holes are created. So as the core of a star collapses, its momentum makes it spin faster and faster, until it collapses into a black hole. The black hole keeps on rotating, never stopping. Black holes rotate approximately a million times a second.
On 22nd November 2014, a burst of x-rays were detected by ASASSN. The All-Sky Automated Survey for Super Novae, but this was no supernova. The signal came from the center of a galaxy around 290 million light-years away. What scientists believe happened, was a star came too close to a supermassive black hole with a mass a million times that of the Sun, and it got swallowed. The black hole fed on the star. As the star approached the side closest to the black hole, it experienced a much stronger gravitational pull than the other side, ripping the star to shreds, with matter spiralling into the black hole forming an accretion disk; an annular disk of gas and dust. Events like this are meant to be rare, occurring every 10,000 to 100,000 years in a galaxy. They are called Tidal Disruption Events.

SP3. BUILDING A BLACK HOLE BOMB

Varvara Muminova
International School of Moscow, Russia

Over recent years, humanity has been maturing and growing. Not only with the level of technology we have achieved but also in terms of the population and its needs. There are many innovative ideas, yet the future holds unexpected surprises. Imagine the end stages of the universe, where would humanity's last home be? Many have been thinking about megastructures like the dyson sphere, enabling the encapsulation of an entire star. The downside being that stars have a short lifetime on a universal scale. Instead, we could use the result of a huge star dying: a black hole. This idea states that angular momentum energy may be transferred from a rotating black hole and used as a power source for future generations. Alternatively, the construction could be altered to build the largest, most destructive weapon: a black hole bomb.
When dealing with concerns of such magnitude as a black hole, it is important to think more critically; how much energy can an individual possess and how harmful is it going to be? Can it be used for other purposes as well?
This presentation will be discussing these and other frequently asked questions as well as analyzing the odds of such a black hole civilization and the powers that a black hole bomb hypothetically holds. If one day the last star would die, black holes might become the last hope for us in a dying universe.

SP4. DARK MATTER: WHY DOES IT MATTER?

Maria Tivanova
The Heritage Private School, Limassol, Cyprus

The mysterious substance called dark matter is the talk of today's Physics. There isn't a single person, who is interested in physics or astronomy the slightest bit, that did not read about it at least once. Yet, we know so little about it. In this presentation, I will explain what dark matter is considered to be, how it was discovered and why it is such a vital part of our Universe. Dark matter is a very challenging, but very interesting topic to research about, which is why I chose it to be the topic for my presentation.

SP5. THE SECRETS OF THE SUBCONSCIOUS MIND

Lucia Hosein, Elizabeth Holt
International School of Moscow, Russia

It has been said that 95% of the mind works subconsciously, and that 55% of communication is through body language, 38% tone and 7% actually consists of words spoken. But how can we test to see if these theories stand up to scrutiny?
In this presentation, we will do just that. Using the biology of the brain, a handful of psychological books, and even some experiments of our own we believe that we can expose all we can about our minds and yours. Furthermore, you will be able to crack the seemingly impossible code of how other people think and perceive you.
Eye contact is surprisingly one of the most important factors of any relationship. We all undoubtedly look at someone differently if we are angry with them, and even if we have romantic feelings for them. Apparently, when meeting a new person, we look at them from eye to eye, all the way to the bridge of their nose; however, with friends our gaze normally drops below eye level and moves in a triangular shape around your eyes and mouth. To prove this, we will be conducting a series of social experiments with some of our fellow pupils.
And although this seems interesting, that is not all. The ventral putamen is one of the brains rewarding systems, therefore it can unintentionally mislead you. Marketing techniques and colourful advertisements are only some of the many illusions used to mislead the human mind into the cycle of consumption and impulse shopping.

SP6. GENETIC MUTATIONS: SUPERHEROS AND LACTOSE INTOLERANCE

Taisia Smirnyagina
International School of Moscow, Russia

What comes to mind when you hear the phrase 'genetic mutations'? Pop-culture superheroes? Physical and mental diseases?
Around 50 years ago, the structure of DNA was discovered and this discovery opened up many new possibilities. Genetics is a complex, yet intriguing subject that tries to decrypt the mystic code DNA is and give an explanation of how this code 'dictates' who we are. From viruses to evolution, genetics is a broad study that covers the topic of this presentation that will focus on genetic mutations.
Throughout the short history of our knowledge about DNA, a certain aura of animosity formed around genetic mutations, creating lots of stereotypes around this field of study. This presentation will shed some light on how the genetic mutations occur, making the subject quite easy to understand even for those with only basic knowledge about DNA. This presentation will proceed to touch on several important topics that have a direct connection to genetics and DNA mutations. For example, 'Are GMO products as dangerous as the media makes them look?', 'how mutations are the propelling force in evolution?' and 'what are the most significant mutations that shaped our species?' These are just a few questions that will be explored in this presentation.

SP7. HOW DO WE LEARN?

Anastasia Vidyaeva
International School of Moscow, Russia

The brain is an extremely complex organ that controls the whole body. It is made of 100 billion neurons that interconnect. Each neuron is connected with 1000-10,000 neural pathways. When a human learns something new, their brain changes. This brain forms new connections, new neurons and makes neural pathways that already exist stronger or weaker. These changes are called neuroplasticity.
There are many theories about how we learn or how it is best to learn, but not all of them have been proven. For example, many teachers have explained to students that different people have different learning styles. However, after extensive research, scientists have not found conclusive evidence for this.
Learning usually requires motivation. This also requires a moderate amount of stress. High or low stress levels both result in low performance and low learning. High performance also depends on enough sleep, a healthy diet and an active lifestyle because they increase neuroplasticity and keep dopamine (a happiness hormone) and cortisol (a stress hormone) at appropriate levels. Doing the opposite will result in reduced brain capacity for high performance. A type of learning called active learning, where the students interact with the teacher and the class, stimulates some areas of the brain and expands memory.

SP8. THE FUTURE OF THE MICROCOSM

Yegor Kim, Pavel Burya, Konstantin Popov
International School of Moscow, Russia

With advances in scientific technology, the prospering field of modern science has witnessed a proliferation of high-skilled specialists, who in turn began to abstain from studying objects as large, visible entities and zooming in to microscopic scales. Quantum dots - nanoparticles of semiconductors ranging from 2 to 10 nanometers - are an increasingly popular theme in science due to the fact that the potential plethora of applications for these dots is gargantuan. It was these nanoparticles which caused a leap in progress in the electronics field - OLED technology owes its vivid colours and plasticity to these nanocrystals - and it was these particles which continue to innovate solar cells due to their fascinating ability to alter its photovoltaic features. From this standpoint, it would not be a stretch to assume their future use in biolabelling and aidance in tracking disease-causing cells (cancer cells for example) in order to achieve targeted and successful radiotherapy treatment as well as tracking any metastases in the organism.
This presentation will shed light on the fascinating properties which enable the quantum dot to emit only a specific wavelength of light, and from a more scientific perspective their structure and subatomic attributes - band gap width and the 3D potential wells they create and so on- making them a very trendy and avant-garde topic in modern science.
This cutting-edge research differs from other projects as it will explore a theme not merely of past scientific discovery, but an exploration into the current theories and concepts propelling science forwards today.

SP9. TRAVELLING IN SPACE, THROUGH SCIENCE

Napolina Yiannakou
The Heritage Private School, Limassol, Cyprus

Science has been improving surprisingly the past few years and it is still improving every day, making our daily life easier. Messages including text, sound and picture can now travel from one electronic device to another device miles away, enhancing communications and bringing us closer. But, could such communications become even more direct or quicker or…more interesting? Scientists have been researching and experimenting teleportation in order to achieve that. Chinese researchers worked on this project and going more in depth, succeeded in teleporting a photon from the ground to an orbiting satellite. Using the method of quantum entanglement, they sent the photon more that 300 miles up, which is the farthest distance tested in teleportation experiments ever.

SP10. ANTI-NUCLEAR MISSILE DEFENCE

Stepan Malov
International School of Moscow, Russia

In recent years, the threat of nuclear war has been spoken about a lot, but not everyone knows how nuclear missiles can be intercepted. This presentation will focus on Anti-Nuclear Missile Systems and how they have helped to prevent World War Three.
At the start of the Cold War, the first strategic ballistic nuclear missiles were created - Soviet R7 missiles. This is the same rocket upon which Yuri Gagarin first blasted into space. Another famous one was the American Redstone, created by Wernher von Braun, who worked with American scientists. These missiles created a problem, as it became very difficult to prevent nuclear attacks. The solution to this problem first came from Soviet scientists. They solved the problem by creating a missile which was supposed to shoot down nuclear missiles. These anti-nuclear missiles were equipped with a homing head, which is programed by the main computer.
The next problem involved how to detect nuclear missiles flying towards a country from the other side of the planet? The answer to this question was also discovered by Soviet Scientists who created huge radars. One of these remains near Moscow and is called “Don-2N”. Using radio waves and a satellite, this detects the ballistic missile flying. One time, it detected a missile and the person operating the radar sent the information to the Kremlin. Fortunately, a glitch in the system was spotted before retaliation could take place. This presentation will look at these systems in more depth and analyse the role they play in keeping our planet safe.

SP11. THE FUSION REACTOR

Egor Kuzmichev
International School of Moscow, Russia

Fossil fuels are running out. If we continue consumption of fuels like natural gas, crude oil and coal at the rate that we are going at right now, there is no chance for survival on our thriving planet. Mankind has been searching for alternative energy sources for a long time, we’ve tried solar power, wind power, power of the tides; yet nothing is sufficient enough to power us for a long time. In the last 60 years scientists have been working hard on finding the perfect energy source and I think they just might have. In the past decade an idea has been roaming the heads of nuclear physicists. What if, instead of splitting the nucleus of an atom by nuclear fission, you were to fuse two protons by nuclear fusion.
In this presentation, I will talk about the ITER (International Thermonuclear Experimental Reactor), what it is and the science behind it. I will talk about what nuclear fusion is, the components of the reactor and how they work, environmental impact, what is its purpose, a brief history and its potential in the future of the planet. Fusion is the future. However currently, it is impossible to achieve, but with the right technology and research, this surreal, farfetched idea will come to life sooner than we think.

SP12. MAXIMUM POSSIBLE DEPTH THAT CAN BE REACHED DURING A FREEDIVE (NLT)

Alisa Polyakova
International School of Moscow, Russia

Freediving is a form of underwater diving based on breath-holding with no additional breathing apparatus used. The depth that a free diver can reach is dependent on many factors such as pressure, temperature, lung capacity, efficiency of oxygen diffusion, negative buoyancy, psychological barriers, etc. The first official freediving record was set by Raimondo Bucher in 1949 when he dove to 30 meters below sea level. This was previously believed to be impossible because at -30 meters human lungs experience 4 ATM and the lung volume will decrease to ¼ of its initial size which, seemingly, would cause them to collapse. Mammals, however, are surprisingly well adapted for diving, some adaptations include mammalian diving reflex (or bradycardia) which decreases the heart rate in response to cold water or submersion in water for extended periods of time.
There are many different freediving disciplines such as Static Apnea, Free Immersion Freediving or Constant Weight Freediving. No Limits Freediving (NLT) is a variable-weight and a non-competition discipline in which weights and fins are used to descend as deep as possible and then ascend via a buoyancy device. NLT is one of the most technical and dangerous disciplines, but it allows the greatest depths to be reached. Currently the NLT record is held by Herbert Nitsch who reached 214 meters below sea level in 2007. NLT requires a lot of training and dedication, but there are still a lot of limiting factors. What is the greatest depth that can possibly be reached during a freedive?

SP14. CHERNOBYL AFTERMATH

Yuna Apryatina, Sofia Musakhanova
International School of Moscow, Russia

Have you ever wondered about the most destructive incident in the history of nuclear power? It happened in the USSR, in 1986, and no nuclear disaster has ever come close to this one in terms of its level of fallout. Imagine that you are a fireman, who has been called to save a nearby power plant from a fire. Seems like an everyday situation. But nobody tells you what exactly happened, until suddenly the whole process starts: your body is attacked by radiation; millions of microscopic, radioactive particles are sent through your skin. And then it all begins. You start feeling nauseous, getting blisters all over your body, contracting headaches and continuous vomiting. It may take a few days, but eventually the sickness will start killing you. Your bone marrow starts shutting down, your immune system fails and your organs and soft tissue start to decompose. In this presentation, we aim to explore the biological aftermath of the disaster. Since the explosion, radiation has caused an increase in animal mutations. Several species of animals were drastically altered, even being born with certain deformed body parts. All of these inexplicable things have happened under the influence of radiation. However, animals were not the only ones who were affected - children are still being born deformed from the victims of the incident, and many generations after us can still become affected, as genes may be passed on for numerous generations.

SP17. HISTORY, FUTURE AND STORY OF IVF

Maria Vilstrup
Rygaards International School, Denmark

The process and concept of In vitro fertilization has proven very important and relevant in the modern-day society we live in today. It is mainly performed to help a female become pregnant who may have faced challenges naturally conceiving, also known as infertility.
The aim of our presentation is to give a brief history of how IVF first occurred, to also explain in great detail the process of In vitro fertilization, and lastly what the future holds for us regarding this subject.
Now to summarise briefly the first successful performance of IVF was performed by Patrick Steptoe and Robert Edwards, in Manchester England on the 25th of July 1978. The method used then had the same basic ideas where an egg is taken from the woman's ovaries and fertilized with sperm in a laboratory and then put into the woman's uterus, of course now the process has become far more technologically advanced and ensures higher success rate. This then leads me to my next part what the future holds for us, we will be discussing many key ideas however one that specifically sparks our interest is the idea of being able to make the sperm cell needed from the man, this could be specifically important for boys who have been undergoing cancer treatment as if they are under the age of 13 when they have cancer they are likely to be subfertile afterward.

SP18. THE POWER OF THE MIND

Sara Švegović
Gimnazija “Fran Galović” Koprivnica, Croatia

As you can say from the title, my presentation is about mind. Humans think and experience emotions with their brain and it is the root of human intelligence. Nervous system is also important because it triggers our reactions, such as making muscles move or causing to feel pain. Because of our behavior, there is science called behevioral science. It is about studying human mind and recognising all the emotions. It can become very important in some crime cases and there are people who are trained to see if people are lying or not. Our brain is an incredible „thing“ to have. Because of it we can think, be creative, recognise and visualise world around us. It is amazing to see how our brain changed through years. It made us more intelligent and people discovered so many things with power of their mind. With our state of mind we can change the world and people around us.

SP21. LEFT OR RIGHT BRAIN - THEORY OR REALITY?

Ana Christina Johansson and Sophia Rosalinda Tammi
Rygaards International School, Denmark

Are you a logical, precise thinker, or would you say that you’re more chaotic-minded and artistic? Most people would say that they are a mixture of the two, as most people are. But if you feel that you are the former, you are dominantly left brain oriented, and if you are the latter, you are right brain dominant. The purpose of our research is to understand what the right-left brain dominance theory is and further our knowledge on how the brain works to find out how accurate the theory really is as well as delving into the psychology of society’s views on the theory.
We have conducted a test applicable for two age groups to see if we can find a trend towards one of the personality types in either group. We analysed the collected data and combined all of the information together. We researched the theory in detail, exploring aspects such as who created it, when it was created, what the theory fundamentally is, and what people's views are on it. We have also zoomed in on the neuroscience of personality, how the brain works and how it affects and connects to the left and right brain theory.

SP22. THE SCIENCE BEHIND EMOTIONS

Anwita Karanth and Lucia Alice Pitman
Rygaards International School, Denmark

We all feel emotions, but have you ever wondered how they work? Or how much we really know about the seemingly simple process that occurs in our bodies on a daily basis.
Our presentation covers exactly this. We wanted to know what triggers an emotion, why some people feel and express more emotions than others, and how this all happens. We've always been fascinated with the flawless working of our bodies, so we decided to see just how they function, and what we can do to make them more efficient.
Emotions are often portrayed as illogical and uncontrollable, although there is still an exact science behind it. If two things so clearly juxtaposed one another, how is the link equally as strong? After some rigorous research, we were able to put together our presentation, which covers items from the role of emotions in prehistoric times, to how emotions are created on a chemical level, to how we can use our emotions to benefit us. We also examined and will discuss what triggers emotions, how different people cope with them, and how emotions affect us physically. Emotions are such an essential and complex part of our being that we often overlook and take for granted. We are ignorant about many things about how humans operate, and this is our way of trying to understand not only ourselves but also one another a little bit better.

SP23. DARK ENERGY AND DARK MATTER

Areeb Sadath Jan
Rygaards International School, Denmark

Observational data collected during the last decades have provided evidence that the vast majority of the universe consists of two "dark" components, a mysterious, collision less dark matter that holds galaxies together and even more mysterious, almost uniform dark energy component with negative isotropic pressure that produces cosmic acceleration. Together, these components capture around 96% of the present day cosmic energy budget. Dark energy is responsible for around 74% while dark matter captures almost a quarter, making it six times more abundant than visible matter. The visible matter is a very small component in the universe since it captures around 4% of the universe.
We don't know the nature of Dark Matter and Dark Energy. However, in this presentation we will discuss the current knowledge and theories about the properties of these two phenomenon.

SP24. ORBITAL MECHANICS OF THE MOTION OF PLANETS AROUND THE SUN

Rohit Roy Chowdhury
Rygaards International School, Denmark

Everyone has heard of the single Nobel Prize holder for his outstanding contributions to quantum physics, Richard Feynman. From path integral, to his innumerous lectures. One in particular given in March 13th 1964, entitled 'The motion of planets around the sun' did not make it into his collection. However, when analysed, one can only comment on the beautiful way he presented his work. The lecture itself is about why planets and other astronomical objects orbit the sun in ellipses. It ultimately has to do with the inverse square law, the fact that the gravitational force pulling on an object towards the Sun, is inversely proportional to the square of the distance between the two celestial bodies. But how does this exactly give rise to an ellipse? Of course, you can try proving this with Keplerian Transition Matrices, but Feynman created something simple and elegant, using only the properties of ellipses and Kepler's Second Law of Planetary Motion. From the property of velocity (a vector), he could imply that orbits are elliptical using special velocity diagrams.
In this presentation, this brilliant proof will be explained.

SP25. PHYSICS OF FOOTBALL

Evgenios Evgeniou, Stathis Matolis, Michalis Mishelis
American Academy Larnaca, Cyprus

Football… The most famous sport that every class of people can easily play! No one can imagine a world without this fabulous sport. But most of the people think that football is too simple and we are here to prove the exact opposite; that football isn't just a sphere that goes round a field. It's a very big thing for Physicists as they can study a lot about it. Have you ever thought about how Roberto's Carlos's Shoot took that peculiar and spectacular direction? A lot of people say it's just a shoot but actually it's a miracle of physics as you need very specific factors for such a shoot to be taken! Have you ever thought why most of the times the penalties are successful? Why is that hard for a goalkeeper to save a penalty? A lot of questions that for some people are very simple are answered behind physics and in this presentation we are going to show how physics and football are interrelated from the first until the last whistle of the referee! In out presentation football will be presented in a more special and unexpected way that will get you excited! Let's see is football as simple as you think?

SP26. GENES AT WORK, A BOARD GAME

Romano Raffaele, Amen Alessandro,Esposito Emanuele
Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy

We do not like boring lessons. That is the reason why we decided to create a board game concerning mathematics, physics and biology, subjects that students do not like very much. In our opinion a game should develop curiosity, interest and desire to deepen into specific topics.
Central cores of the game are the genetic code and the Vigenere's code, evolutionary stage of today computer science. It is a full-immersion in the boundless theme of "transformations", declined in an evolutionary sense, in changes of state, in system conversions and more. The aim of the game is to conquer one evolution protein that is represented with a "protein" card, which each player draws at the beginning of the game. The first to conquer all the amino acids contained in his protein card wins. Players are challenged with encoding and decoding activities, with "contentions" and with the timeline.
We really enjoyed ourselves during the creation of the game. We choose a series of proteins representative of every living species on earth, respecting a chronological order of appearance. We started from the very first organisms present on earth. The purpose of the game is to understand that the evolutionary steps are linked to a different combination of amino acids that form a different protein.
We are convinced that our game is strategic, casual, fast, formative and inclusive and we hope you will find it very interesting.

SP27. YES, CELLS COUNT

Federica D'Agnese, Serena Pagano
Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy

Our presentation was born in response to one of the most recurrent fears about health and the desire to overcome it through scientific knowledge and objectivity: cancer.
We organised a guided tour to the National Research Center in Naples. Researchers showed us their laboratories and illustrated us the main phases of their research on the subject. Once at school we replied the experiment.
We studied that there is no single disease called cancer, some properties are common to all cancers and only the cells of a malignant tumours tend to invade the surrounding tissues.
We had the chance to work with cell cultures in vitro and observe cell proliferation. Our studies were followed by graphics created in class with the help of our teachers.
Using our science lab was a highly educational experience as it allowed us to understand what it means to do research every day in order to improve our lives.
It was not easy for us to work on these complex and difficult issues and to deal with a disease like cancer, but we must know that the research is moving forward; considerable progress has been made and we should thank and trust those who dedicate their lives to search.

SP28. LIGHT, WAVE OR PARTICLE?

Hritik Roy Chowdhury
Rygaards International School, Denmark

The wonderful mystery leaves quantum physicists puzzled with the question, “What is Matter?” With the work of many scientists around the world for over centuries, a theory has developed called Wave Particle Duality. This theory proves why the smallest (subatomic) particles behave as waves in certain situations and as particles in other situations. By using Thomas Young’s double slit experiment, we are able to determine if something is a particle or a wave by observing their interference pattern. By using Albert Einstein's photoelectric effect, for which he was awarded the Nobel Prize, we can prove that light is a stream of “energy packets” which travel in discrete amounts just like particles. In quantum physics, scientists believe that subatomic particles aren’t waves or particles, they just behave like a wave in some cases and as a particle in others, and therefore are referred to as “quantum objects.” Electrons, for example, are thought to be particles, however when electrons are fired randomly at a double slit experiment, the result is ground-breaking. Electrons, being particles create a pattern similar to a pattern you would see created by a wave. So does this mean that electrons are waves too? In this presentation we do not attempt to answer only to scratch the surface of that mysterious question: “What is Matter?”.

SP29. WEB RADIO LIVE

Alberto Pesce
Istituto Statale per l’Istruzione Secondaria “Europa”, Pomigliano d’Arco, Naples, Italy

Our school hosts a web radio called “radioeuropalive”. We created the radio some years ago because of our passion for music and science.
Music amuses, makes you dream, comforts and is one of the first things we learn to appreciate. Webradiolive is entirely designed, managed and realized by young people for young people, it is a new opportunity to give a voice to students.
Its strengths are that we are considered as "protagonists", families and friends are involved and it is an alternative path for disciplinary in-depth. Furthermore, it contributes to the life of the territory, but it does not leave the global reality, through the collection and dissemination of information and of important issues such as inclusion; smoking; bullism and cyberbullism.
We used science to create our radio and we would like to show you how we managed to control the reverberation and the acoustic isolation.

SP30. IS LAB-GROWN MEAT SUITABLE FOR MASS CONSUMPTION?

Bakogiannis Eleftherios, Chatzakou Christine, Kakos Nickolaos, Nikolaou Konstantina, Tamvakas Chris
The American College of Greece-Pierce, Athens, Greece

Omnivore eating is a part of human mentality. People have been eating meat since the very beginning. But nowadays due to environmental and ethical reasons, many have seeked alternatives to meat consumption. Although vegetarianism and veganism are “trendy” options with benefits of their own, there is a way to consume meat, while also preserving sustainability. That is none other than artificially cultivating meat. Made from the animal’s own stem cells, lab grown meat is not just a substitute, but meat itself. The idea to grow meat in a lab has existed for many years; but only recently has it started having real potential. That is mostly due to the meat industry’s huge CO2 and methane footprint and the livestock’s need for immense amounts of water and grain, all of which aggravate the ongoing climate crisis. The numerous advantages of lab-grown meat can also have a great impact on human health, as the antibiotics used on actual livestock have no particular significance on the sterile and controlled environment of a meat cultivating lab. Diseases like Salmonella and Staphylococcus (caused by bacteria) are also prevented. So, what is keeping lab-grown meat from the supermarket shelves? Unfortunately, due to the high production cost and the uncertainty of whether such a product would appeal to the public, mass production is being held off at the moment. However, with the correct marketing techniques, the popularization of lab-grown meat would be easily impelled.

SP31. CAR T-CELL IMMUNOTHERAPY: REVOLUTIONIZING CANCER TREATMENT

Ploumis Georgios, Sadopoulos Evaggelos Angelos, Tsikou Vasiliki Silvia
The American College of Greece-Pierce, Athens, Greece

Cancer has plagued humanity and startled modern medicine. The development of a universal cure for all cancer types was thought to be an incredible, borderline impossible feat. That idea is being brought down by a new treatment method. CAR T-Cell immunotherapy has shown promising results for curing many types of solid tumors. It is a revolution in cancer treatment, genetic/bio engineering and medicine in general. Chimeric Antigen Receptor (CAR) expressing T-cells (CARTs) have shown promising results in selective tumor identification and eradication. Successful results have been observed at the treatment of solid tumors, liquid tumors and hematologic malignancies. This review will be focusing on the methodology, applications and processes of production of CARTs as well as their efficacy and their viability as an actual cure for tumors and other malignancies. Factors such as price and availability for people with a difference in socioeconomic status will be considered. Finally progress in the approval processes in different countries/nations will be reviewed.

SP32. THE NEW ERA OF ELECTRIC VEHICLES

Mistrioti Myrto, Tasouli Vasiliki, Karamouzi Vasileia, Bouris Eleni Ioannna, Mafoutsis Yasmine
The American College of Greece-Pierce, Athens, Greece

We live in an era where technology evolves rapidly and in an unprecedented way. This year the Nobel prize in Chemistry was awarded to three scientists that worked for the development of powerful and lightweight lithium-ion batteries. Therefore, a future with a fossil fuel-free society is possible, where these batteries are used in electric vehicles. This paper begins with the history of electric cars from their invention up to now and an analysis of their operation. Moreover, emphasis is placed on the environmental aspects of electric cars, the effect on the power grid if everybody uses them and the safe disposal of their old batteries. This research also examines how a battery works, includes a short timeline of the most significant ones and the spotlight then falls on lithium-ion batteries. Although battery powered electric cars might seem like a good option, at this moment the world is not yet ready to fully support an exclusive worldwide use of electric cars. Last but not least, a survey will be presented about the use of electric cars in Greece and other European countries.

SP33. LIGHT BULBS, LET'S SEE IT CLEARLY!

Esposito Emanuele, Romano Raffaele,Amen Alessandro
Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy

The advantage of low-consumption light bulbs is considerable. By replacing a 75-watt incandescent lamp with an equivalent low-power consumption, you save up to 70% of the costs.
My presentation aims at using math to understand the importance of money and energy saving when using LED light bulbs instead of traditional lamps.
In my opinion, people should think about the importance of LED lighting. If in a year in Europe you save 7 billion euros with the transition from traditional fluorescent lamps, and the power of a LED light is 16% of fluorescent light, how much will you save in Europe with the adoption of only LED lights? You will find the answer in my presentation.

SP34. COPY AND PASTE…THE FUTURE?

Eleni Maria Vlotomas
International School of Paphos, Paphos, Cyprus

Yes. In nature there are many forms of cloning, some plants and single-celled organisms, such as bacteria, produce genetically identical offspring or even twins. More than 2,000 human diseases and abnormalities have a genetic causation. Such problems can be solved by cloning technologies which can be applied to a variety of platforms and can serve multiple functions, so why don't we? The proposal to enhance the human genetics by genetic cloning of individuals is not warranted in many countries. From a technical perspective, cloning humans and other primates is more difficult than in other mammals which has led researchers to practise cloning on other organisms such as sheep and have observed some adverse health effects. Therapeutic cloning will bring enhanced possibilities for organ transplantation, nerve cells and tissue healing, and other health benefits. If there are so many advantages to cloning, so many potential uses and lives to be saved, yet we wrestling with the ethical dilemmas. Both reproductive and therapeutic cloning raise important ethical issues, especially in humans. This may conflict with long-standing religious and societal values about human dignity, possibly infringing upon principles of freedom and identity. My last question is, is a human that is cloned, still a human? does it have rights? If a genetically modified human is created what would they think of us 'normal' people? what would our place be in society be?

SP35. OUR VULNERABILITY TOWARDS OUR CYBER LIFE

Arian Adeli Koodehi
International School of Paphos, Paphos, Cyprus

Nowadays computers play an important role in our everyday life. We have more personal information stored in our computers rather than our brains. People are so concerned whether their belongings are safe, how come no one is concerned about their cyber life?
This presentation will also be an experiment aiming to identify our weaknesses in a real-life situation. There will be 3 people set as an example provided with laptops by the presenter, they will all be guided through a process that we do on daily basis, however, this act is meant to distract them and a malicious program previously programmed by the presenter will be installed on their personal computers and it will send an email containing some personal information and a photo from their computer, showing how easy it is to take control of people's personal lives. This will take into account how mathematics can be misused to create algorithms for malicious software and harm people in different ways, we will also touch on how this program was actually created and how the presenter managed to trick them into this trap.
It is worth noting, this software was created by the presenter from scratch and no personal info will be leaked or misused during this experiment.

SP36. CELEBRITIES AND GLOBAL WARMING

Andreas Tavros
International School of Paphos, Paphos, Cyprus

From the minute we set our foot in school, they teach us how to "respect the environment, so the Ice in the poles doesn't melt". Recycle, Reduce, Reuse is the motto. As levels of Carbon Dioxide and other greenhouse gasses increase, more heat is "trapped" in the earth's atmosphere and global temperatures rises which leads to weather extremes. Global efforts to tackle climate change rest on a common goal: to keep the planet's temperatures from rising beyond dangerous thresholds. Scientists are still working to understand some aspects of how the Earth responds to rising greenhouse gases in the atmosphere. Statistics warn that the increase is exponenti al, raising the red flag for the coming years. The current steps taken to deal with this problem are informational meetings to increase awareness, switching to sustainable sources of energy and introducing Carbon Capping. Google Camp is an annual meeting in Sicily, which is meant to be a place where influential people get together to discuss how to make the world better. In recent years the attention has been directed to the rising emissions of Carbon Dioxide, pollution and global warming. Every year more than 100 private jets travel to Sicily, which is the equivalent of more than 784,000 Kg of CO2 emission and a $20 million cost for a 3-day extravaganza, of famous people discussing climate change, this is a true irony.

SP37. PROSTHETICS

Nersu Yahi
Mediterranean High School, Larnaca, Cyprus

The topic that I chose is prosthetics. ı chose this topic because it relays to human use, science and mathematics. Prosthetics is an artificial that replaced to your missing part of your body. Most of the population losses their body part at works.
Is horrible that people that don't have money, loses their body part and they can't afford to buy a prosthetics because they are so expensive. In my opinion prosthetics arms or legs are stronger than our normal body parts but there are not that esthetic and you can't use them that original like your normal body part. A person's prosthetics should be designed and assembled according to the person's appearances and functional need. Our normal hand makes 100% moves but a prosthesis hand makes 40% movement because our technology didn't expand that well. In prosthetics there are different parts in it and there are only 3 people in this whole world knows all of the parts because people learn only their part. To do prosthetic's you need to know different techniques and there are different parts in sciences. A person could take only physics or chemistry or biology, that's why there are only 3 people in this whole world that know all of them. The way that they design in on computer and the way that they design it with hands has big difference. Every person who designs on their hands has different types. To explain all the parts I would need weeks to explain it but I will only take one part of all the parts and explain it. This is the topic that I wanted to explain you. I chose this topic because no one did it before and people should be aware of it.

SP38. WHAT WILL HAPPEN IF EVERYONE IN THE WORLD WENT TO SLEEP AT THE SAME TIME AND WOKE UP AT THE SAME TIME?

Alex Kalaitsidis
Mediterranean High School, Larnaca, Cyprus

This Presentation will be about, "What will happen if everyone in the world went to sleep at the same time and woke up at the same time?" I will be discussing the effect this will have on Earth. Including, what will happen to the Daily Lives that we as humans will have.
Furthermore, the effect on Climate. In addition, what will happen to the animals around Earth. Pictures and some interactivity will be included as a way of having a good conversation with the audience. A section where I might ask to audience to participate in/ imagine. The theory behind the question "what will happen if everyone in the world went to sleep at the same time and woke up at the same time?" What will happen to the jobs that we are doing, and how will we adapt to this sudden change in doing. How would Carbon emissions do-increase or decrease-? Talk a little about China and how they have a similar system of day and night cycles and they have a universal time zone around its whole country.

SP39. AUTISM SPECTRUM DISORDER

Maria Yiasoumi, Destine Akokcu
Mediterranean High School, Larnaca, Cyprus

ASD is a developmental disorder characterized by difficulties in social interaction, communication and behaviour. Parents usually notice signs during the first three years of their child's life. More noticeable begin after the young age of six months, in most cases. Because of the shape and structure of the brain. Autism is 4 times more prominent in boys compares to girl. Symptoms of ASD are: difficulty with communication, difficulty with social interaction, restricted interests and repeating behaviours. There is no known single cause of autism. It is generally caused by abnormalities in the brain structure. Congenital rubella syndrome is one of the known convincing environmental causes of ASD. This can happen by gastrointestinal problems, genetic factors or if two older parents decide to have a child. The positive aspects of Autism Spectrum disorder are, if someone has this type of disorder than, in some cases, they have average or above average intelligence. ASD varies in severity, and is understood in a form of continuum- from mild to severe. This refers to the level of impairments the individual will have. Autism spectrum disorder affects the nerve cells which are located in the brain. ASD damages the cells and this causes them not to function properly in certain areas. This developmental disorder develops from the time the person is in the womb. When a woman is pregnant, she has to protect herself. She must be careful and clean. If an expectant mother had alcohol this causes damage in her baby's brain. Pesticides and air pollution cause damage as well. The parents can notice signs of Autism when their children: do not make eye contact with others, show less intention to interact with others. Some people who have ASD also have sensory difficulties, and may struggle with being touched, hearing specific sounds or with light. When a small part of the brain doesn't function properly, the rest of the brain takes over the unused part and strengthens the rest of the factors in the brain. Autistic individuals think differently than the rest of us. They have been described as thinking out of the box, and this has resulted in many changes in the world. Albert Einstein, Mozart and Alan Turing are suspected of being on the spectrum. Greta Thunberg who is creating significant awareness and difference in climate change is also on the spectrum.

SP40. TELEPORTATION: WHAT IS IT REALLY?

Anna Kalaitsidou
Mediterranean High School, Larnaca, Cyprus

In this presentation, I will be presenting what teleportation is really.
Teleportation is the hypothetical transfer of matter or energy from one point to another without traversing the physical space between them. Teleportation is the ability to transport a person or object instantly from one place to another, it is a technology that would change the course of civilization and alter the destiny of nations. If realized for humans, this amazing technology would make it possible to travel vast distances without physically crossing the space between. You can never transmit information faster than light. Teleportation requires a separate classical communications channel as well as a quantum channel. You can't use teleportation to transfer a physical object. After teleportation occurs, the entangled particles used in the teleportation process are no longer entangled. I will also be talking about Quantum Physics. A fundamental physical constant occurring in quantum mechanics is the Planck constant, h. A common abbreviation is $\hbar = h/2\pi$, also known as the reduced Planck constant or Dirac constant. The general form of wave function for a system of particles.

SP41. DO YOU WISH YOU HAD A DOLPHIN'S BRAIN?

Elli Paphiti
International School of Paphos, Paphos, Cyprus

Humans only use 10 percent of their brains cerebral capacity. This sounds so compelling—a precise number, repeated in pop culture for a century, implying that we have huge reserves of untapped mental powers. But, 10% is not too little if you think about all we have done with it. Now imagine having the ability to use more than that. Well, there is one animal that uses their brain better than us; the dolphin. It is estimated that this incredible animal uses up to 20% of its cerebral capacity. This allows it to have an echolocation system that is more efficient than any sonar invented by mankind. The dolphin, however, didn't invent it but its system developed naturally. If we could to this, then hypothetically accessing a higher percentage of the brain could give the ability of controlling certain parts of the body. This has not yet been possible with the human body and its cerebral capacity. This is reflected in a conflict we have today; that humans are more concerned with having than being. Dolphin's social interaction skills are fascinating as they give each other "names". Scientists have found further evidence that dolphins call each other by "name" using a unique whistle to identify each other. They are capable of complex problem solving and they can use their senses to mimic a human's movements even if their sight is not accessible. They switch to another technique: emitting sounds, listening to the echo and interpreting the resulting sound waves.

SP42. A STEM CELL DEBATE

Eleni Diogenous
International School of Paphos, Paphos, Cyprus

Few advances in science have generated as much controversy as the discovery of stem cells did. Although many types of stem cells have shown a great potential in the treatment of certain diseases, the focus is on the embryonic stem cells. Stem cells are undifferentiated cells that have the ability to differentiate into specialised cell types. The potential of hESCs to replace dead or damaged cells in any tissue of the body may herald the advent of a new field of medicine that can provide cures for diseases currently thought to be incurable such as diabetes type 2, Alzheimer and Parkinson. These remarkable cells have captured the imagination of scientists and clinicians alike and given a new sense of hope to patients. Although the public controversy surrounding the use of hESCs arises primarily from the technique required to harvest these cells from the human embryo, logistical, technical, and legislative hurdles to the use of hESCs also exist. Different countries have chosen to regulate embryonic stem cell research in very different ways. Stem cells have great potential in a new section of medicine but much still needs to be learned about their biology manipulation and safety before their full therapeutic potential can be achieved. Many clinical trials have been subject to ethical dilemmas, however providing valuable answers for the future.

SP43. BEAUTY COMES FROM WITHIN

Salomi Perikleous, Tanya Vinogradova
International School of Paphos, Paphos, Cyprus

Skin care is a huge global industry. Women, and more recently men, have been spending vast amounts of money on skin products and fillers in order to achieve youthful looks for a longer time. Teenagers, as young as 15, are having Botox, facelifts are taking a toll on more mature ladies, and chemical facials are freely available by non-specialists, putting people's life in danger in a variety of ways. These are mostly short-term effective, with most individuals only pitching in beauty regimes when it is too late. Wrinkles are due to a loss of the extracellular matrix/collagen. This supplies skin with its tensile strength and elasticity. Much research lately has been focused on delivery of nutrients, collagen, vitamin etc. from beauty creams. There is excessive research focusing on Nano-delivery, phospholipid compatibility with oil/water based products and non-invasive techniques. We are what we eat! Focusing on receiving the much needed nutrients can help from a very early stage, the prevention of the side effects of aging. The goal is to determine what is not supplied efficiently in the amounts needed, and targeting the problem from our diet, instead of relying on short term solutions. The combination of the correct products and diet will contribute to healthy glowing skin.

SP44. FERMI PARADOX

Foteini Kioutsouki, Evangelos Neophytou
The Grammar School, Nicosia, Cyprus

There are 100-400 billion galaxies, each home to 100 billion stars and at least 5% of those stars are sun-like. Imagine that for every grain of sand in the world there are 100 Earth-like planets. One would wonder, why should this prevent intelligent life from developing in other parts of our Universe?
This was a big question for physicist Enrico Fermi who introduced the Fermi paradox. A concept saying that although there is still no apparent evidence, there is a high probability for the existence of extraterrestrial civilizations elsewhere.
The Drake Equation provides mathematical proof for the number of technologically advanced civilizations in the Milky Way. We can see how the different variables of the equation come together to give a reasonable probability of life on other planets. However why haven't we made contact yet?
Is our insufficient intelligence the one to blame? Are our mathematical skills and technology far too underdeveloped to detect ET?
The Von Neumann probe is a self-replicating device that could, one day, be used to explore every angle of the Milky Way in a relatively small amount of time.
Many proofs have been found and many theories have been made so far. Through the upcoming presentation we can see how the fermis paradox is related with the multiverse theory and what we can do to eventually come across these creatures we have been searching for, for years.

SP45. SCHRÖDINGER'S CAT

George Rovanias
The Grammar School, Nicosia, Cyprus

Quantum mechanics is a branch of physics that is well-known for its complex and bizarre nature. Thanks to the thought experiment "Schrödinger's Cat", devised and presented by the Austrian physicist Erwin Schrödinger, we are able to get a taste of exactly what makes quantum mechanics so strange to begin with along with a basic understanding of how real life objects (such as a cat) would behave if they had the properties of subatomic particles. The scenario of Schrödinger's cat presents a hypothetical cat which is trapped in a metal box containing a flask of poison that is connected to a radioactivity monitor. The condition of the flask dependents on the state of a single unstable radioactive isotope – if the atom decays and emits radiation, the flask shatters and the cat is killed by the poison and if the atom does not decay, the flask does not break and the cat remains alive. However, if one were to follow some of the basic principles of quantum mechanics, the cat will eventually find itself in a state where it is both dead and alive at the same time until the metal box is opened and the cat is observed, a state described as a superposition. This phenomenon can be explained through several interpretations of quantum mechanics all of which are showing off the strengths and weaknesses of each of the major interpretations, which are going to be covered.

SP46. VIRTUAL REALITY

Theofanis Themistocleou, Nicole Charalambou, Davina Bentley, Marilena Constantinou
American Academy Larnaca, Cyprus

Virtual Reality (VR) is the computer-generated simulation of a three-dimensional image or environment that can be interacted by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors. Our presentation is going to include the importance of virtual reality and the different uses which the society will be able to use it in its daily life, such as a future way of communicating with each other, cooking and many more! So, it includes many different kinds of activities in our lives! This evolved discovery is going to be beneficial as it will have a long term life and it will have a big impact in our lives. Moreover, we are going to talk about the many uses of VR such as in the military, healthcare and education. Also, we are going to present about the progress of VR for the next years and how it will become a normal thing in the coming years. Being a new technological invention it can make the education easier and more enjoyable, and it enables the user to be in an artificial environment. However, it consists of complex technology and the equipment used in VR are very expensive to buy. To conclude, in our presentation we will include a variety of videos, interact with the audience and show them both physically but also digitally how VR works!

SP47. PRODUCING RENEWABLE FORM OF ENERGY FROM AGRICULTURAL BIOMASS

Kiril Ristevski, Gordana Todorova
Mentor: Bejhan Bilali
Yahya Kemal College, Skopje, North Macedonia

The project we've came up with is mass producing bioethanol. The main point of the project is to show that we can produce ethanol using renewable sources, in this case we decided to use banana peels since they just get thrown away without being used. At first we gathered banana peel waste and as the first step we used distillation as a way of purifying the used product by a process of heating and cooling and removing the essential oils from the fruit peel thus making it fully solid. We used two ways of drying the banana peels depending on the time period of drying. The first method would be the shortest time period wise which includes drying the banana peel waste in a 200 F oven, spreading them on a parchment paper-lined baking sheet for about 25 to 30 minutes or simply letting them dry normally at room temperature in the span of a few days. Hydrolysis of banana peel waste was carried out with dilute sulphuric acid with the objective to determine the optimum operating conditions that yield maximum sugar concentration. Then enzymatic hydrolysis occurs which is a process in which enzymes facilitate the cleavage of bonds in molecules with the addition of the elements of water. It plays an important role in digestion of food and in our case it used to help with cellulosic ethanol. Hydrolysis is widespread in nature and many enzymes that catalyse hydrolysis reactions. At the end of the experiment we used fermentation which is a metabolic process in which an organism converts the carbohydrates of the banana peel into alcohol.

SP48. CONVERSION OF WASTE INTO NON-RETROGRADABLE ECO-FRIENDLY SOLUBILIZING AGENT

Rozafa Cana
Mentor: Bejhan Bilali
Yahya Kemal College, Skopje, North Macedonia

Dairy wastes are important for producing environmentally friendly, biodegradable and nontoxic sovents. In our research is used sugar milk, lactose for producing ethyl lactate which has been holding as a promising replacement of the petroleum based solvents in world markets. As a green solubilizing agent, ethyl lactate has many advantages compared with other organic-based solubilizing agents. It may be readily purified because it is prepared from natural and renewable soruces. It is completely biodegradable to carbon dioxide and water. It is easy and inexpensive to recycle. It is a nonozone-depleting chemical, poses no hazard as an air pollutant and is non carcinogenic and noncorrosive. According to our research we used lactose and three different types of acids: citric acid, acetic acid and salycilic acid. When we add acid into lactose the process of fermentation is occurred and it is formed lactic acid and ethanol. Lactic acid fermentation is a process by which glucose and six carbon sugars, are converted into cellular energy and the metabolite lactate, which is lactic acid in solution. Even though lactose is not soluble in citric acid it can be part of its fermentation, but both lactose and citric acid are soluble in ethanol and in this way we get the wanted results. For calibration in the process is added 0.01M NaOH. After adding base is formed sodium lactate and ethanol. For improving the process of esterification we added ethanol, produce pure ethyl lactate.

SP49. MACHINE LEARNING AND ARTIFICIAL NEURAL NETWORKS

Haris Papadopoulos
Delasalle High School, Thessaloniki, Greece

Machine learning is a subfield of Artificial Intelligence which emphasises on using data and statistics alongside with computers to give solutions to problems that can't be solved with conventional algorithms due to their very complex nature. Machine learning uses prior knowledge (data) to make predictions about certain outcomes, the accuracy of the predictions gets higher the more good data is used. In this paper follows a deeper, more technical explanation of machine learning and a look on how one of the most popular machine learning systems (artificial neural networks) works.

SP50. MODERATE DEATH

Efstathiadou Konstantina, Koralia Karapataki, Chrysovalandia Menicou, Anna Orthodoxou
American Academy, Larnaca, Cyprus

Cancer is an abnormal growth of cells which tend to increase rapidly by number in an uncontrollable way. In some cases they metastasize, which means to spread to other sides in the body. Our presentation will deal with brain tumors, which can be cancerous or noncancerous. When they grow, they can cause pressure in the skull and become threatening for the patient's life. While other cancers are categorized by stages, brain cancer is assigned a "grade" based on its pathologic features, or how the cells look under a microscope. There are many types of treatments for brain tumors which can vary depending on a number of factors including the type, location and size of the tumor as well as the patient's age and general health. Our presentation will focus on the treatments for cancer, mainly surgery, radiotherapy and chemotherapy. The most commonly performed surgery for removing a brain tumor is called 'craniotomy', which means cutting into the brain to carefully remove the tumor.We will present a description of surgeries and how they have certainly improved over the years due to new experiments and research taking place in labs. One of the most common ways of testing new methods and carrying out experiments is the use of animals; however specific rules must be followed for their protection. We will present how scientists try to treat animals ethically to avoid suffering.

SP52. CLEANING UP OIL SPILLS WITH NANOTECHNOLOGY AND MAGNETS

Christina Rokana, Artemis Tsopanelis
*Geitonas School, Sternizes Koropiou, Greece

Accidents in shipwrecks, tankers or oil extraction facilities threaten the environment with pollution. This poses a constant nightmare to marine and coastal ecosystems.
The Mediterranean Sea lies at the crossroads of oil transport routes and the risk of oil spills is high. For example, on September 10th, 2017, the tanker Agia Zoni II sank in Saronikos Bay, off the coast of Salamina Island. The sinking of the tanker carrying 2,200 tons of fuel oil coated some of Greece's most popular beaches in thick, black sludge and left behind a huge environmental and financial disaster.
The difficult task of cleaning up oil spills in oceans and seas has burdened science and environmentalists for a very long time. The cleanup is always hard. Traditional methods are costly, involve a great deal of time and resources, and have controversial results leaving always a significant amount of residual oil in which very toxic chemical solvents are used for elimination.
However, nanotechnology can help.
Today, scientists are coming to the rescue and are trying to use the benefits of nanotechnology as an alternative to the use of potentially harmful chemical dispersants. The project we are about to present involves the implementation of a new technique that combines nanotechnology and magnetism.
The idea is based on a very simple process. On its own, oil is not magnetic but when mixed with nanoparticles that contain iron, the oil can be magnetically separated from the water.
We study the efficiency of separating oil from water using various amounts of ferrofluid and a strong neodymium magnet. Can we help the environment through this method? Can we clean oil spills in seas without more chemicals just by the aid of nanotechnology?

SP54. GENE THERAPY

Bampatsias Stergios*, Pantazis Angelos**
* Varvakeion Model Junior High School, ** Varvakeion Model High School, Greece

The term gene therapy refers to the intervention of foreign DNA in an organism's genetic material with the aim of correcting the phenotype of the target-cells (correction of genetic anomalies or acquisition of new properties). This process is carried out with the use of a vector (virus carrier) of the desired gene (transgene) which is inserted into the patient's cells via the procedure of transfection.
The application of gene therapy has raised a number of important moral, legal and social issues and has frequently troubled the scientific community. The concerns revolve around the safety related to the use of vectors, lack of knowledge connected to the long-term consequences of the insertion of the gene, the high cost as well as the impossibility of applying it to multifaceted deseases such as cardiovascular conditions and diabetes.

SP55. TRAVELLING WITH TIDES

Giorgos Alexandrou , Marcos Phinikarides
The GC School of Careers, Nicosia, Cyprus

For years, people question why the ocean rises. It was Sir Isaac Newton who explained that this is due to the tides. But do people know what tides are?
The world's largest tidal range of 16.3 metres occurs in the Bay of Fundy, Canada, and the United Kingdom regularly experiences tidal ranges up to 15 metres between England and Wales in the Severn Estuary. What is the force that causes this huge body of water to move though?
In our presentation we will thoroughly analyse tides and show how the gravitational forces of the Earth, the Moon and the Sun interact to cause tides. We will talk extensively about the effects of tides, their behavior, as well as who first discovered these effects. We will look into the effects on the tides as the moon moves further away from the earth, what high and low tides are, what the 12th rule of tides is.
Are tides just a movement of water or is there a force that causes this behavior? We want to quench your thirst and fully explain tides but you need to be careful, cause as the French Astronomer François Arago once said: 'Studying the tides is the tomb of human curiosity.'

SP56. TO EAT OR NOT TO EAT

Erato Markantoni, Gregoria Samouti
The GC School of Careers, Nicosia, Cyprus

Humans often believe only what they can see with their own eyes, but not everything is visible with the naked eye. In 1676 the first discovery on bacteria was made, yet 344 years later, all of our molecular knowledge evaporates to the sight of a seemingly clean cookie that has just been picked up from the floor. Based on the love humans have for food, the 5-second rule was created, to justify their need to eat that cookie from the floor, as they claim that no bacteria will transfer to the cookie in such a very short time. This presentation investigates if the 5-second rule stands, by performing an experiment.
During the experiment, foods such as halloumi, bread and apple, have been dropped on a clean floor, a dirty floor and a carpet, for a time period of 5 and 60 seconds. Bacteria were swabbed from the surface of the foods, cultured on agar petri dishes and finally quantified. This was done to observe whether the time the foods were on the floor, the clearness of the surface and its composition play a role on the population of bacteria present.
But why stop there? We didn't. We dove further into the biological mechanisms that drive the transfer of bacteria, all the fun underlying chemical reactions that take place and all the physics laws that bond them all together. So, after all these, what is the verdict? Can we eat food off the floor, and if yes, what, where and when?

SP57. THE SCIENCE BEHIND SUPERHEROES

Georgios Karagiannis, Petros Kyriacou, Stylianos Lois, Stylianos Tamasios
The GC School of Careers, Nicosia, Cyprus

Becoming a superhero is every child's dream. We have all stared at our screens in awe of the magnificent tales of heroes told by Marvel. There is just something alluring about the heroes' unbelievable powers, their immense strength, their noble stature and their incorruptibility. These are the characteristics that make superheroes amazing, but at the same time so distant and unexplainable.
This presentation will tear the mantle that has been separating us, humans, from them for so long and reveal the actual science behind many of the most iconic movie scenes and superhero abilities. In this presentation, insights of all three natural sciences were used, to find out whether what we see on the Big Screen is actually possible in real life, and whether there are any real life examples mimicking the heroes.
You will be surprised to hear that the findings of this work suggest that many of the most iconic superhero scenes in recent cinema history are in fact theoretically possible, and to top it all off, this presentation will describe organisms and human-developed technologies that function and perform to a level comparable to that of the superheroes. There have even been instances where the observed organisms outperform the superhero.
This presentation has merged Physics, Biology and Chemistry together to make Hulk's thunderclap, Thor's mighty hammer and many more, easier to comprehend and to make you realise that science fiction is more science than fiction after all.

SP58. THE POWER OF THE SUBCONSCIOUS MIND

Carolina Hadjidemetriou, Dimitris Kassianides
The GC School of Careers, Nicosia, Cyprus

Until recently, the subconscious mind was described as “the shadow of our conscious mind”. Nowadays, with recent studies, there is substantial evidence that the subconscious mind is as flexible, complex, controlling and action-oriented as the conscious. The power of the subconscious mind goes beyond our understanding of the way our body functions. Although our brain is highly programmed, our thoughts and actions have a huge input on its programming.

Someone may think that while we sleep our brain shuts down; however, when we sleep our conscious mind shuts down while the subconscious works harder, processing everything that happened during the day. Subconsciousness is responsible for our dreams connected to our daily life experiences, and for prophetic dreams. According to studies, pregnant women who had an intuition about the gender of their baby were 70% correct, but women who dreamed about it were 100% correct. Studies also proved that blind people may dream visually, and a case of craniopagus twins who experience each other’s feelings, confirms the extraordinary power of the subconscious mind.

Subconsciousness explains why people in a coma have dreams. Environmental triggers can influence dreams in a coma, since the subconscious mind is still awake. Highly impressive cases of people waking up from a coma and being able to speak fluently a foreign language have been reported.

This presentation will investigate the link between subconsciousness and dreams, dreaming while in a coma state, cases of siamese twins, as well as how the subconscious mind can be controlled with hypnosis.

SP59. STRING THEORY- THE POSSIBLE THEORY OF EVERYTHING

Melina Bell
Geitonas School, Sternizes Koropiou, Greece

String theory is a theoretical framework that has been put together to answer some of the questions which the Standard model of particle physics failed to answer and possibly to replace it. With the Standard model we treat elementary particles as points, whereas string theory suggests that the point-like particles are replaced by high-vibrational one dimensional ‘strings’ and it describes different elementary particles as different modes of vibration of the string.

One of the main reasons that a new theory had to be created was the fact that the Standard model does not consider gravity. If string theory were to be proven, it would unify all the fundamental forces, such as gravity, electromagnetism, strong nuclear force and weak nuclear force. It has been applied to a variety of problems, such as black hole physics, early universe cosmology (eg. Big bang explanation) and condensed matter physics (eg. Dark matter) and has presented quite promising results.

However, one of the main problems that has arisen with string theory is the fact that it requires multiple dimensions. In the abstract presentation, I will be talking about the problems that string theory gives answers to, but also about the problems it creates and the possibilities for experimental verification of the theory.

SP60. WIM HOF METHOD

Jošt Lombardo
St Stanislav Institution, Gymnasium, Ljubljana, Slovenia

Wim Hof is a Dutchman, known for his incredible endurance stunts and world records. He developed a method, consisting of breathing exercises, cold exposure and meditation, which allows him to withstand extreme temperatures, control his heart rate, raise his body temperature and even influence his immune system with his conscious mind to defend against illnesses. The method is practiced by many world class athletes to increase energy levels and endurance.
I took the method up for a few months, to see, how it would influence my health and overall well-being and it was a very positive experience. In my presentation I go into detail about the science behind the major benefits and why performing these seemingly odd practices can have such a huge effect on the human physiology.
In the first part I will talk about the breathing aspect of the method, how it affects the oxygen to carbon dioxide ratio, blood alkalinity, hormone excretion and inflammation and why it is a beneficial practice.
In the second part I will explain the benefits of gradual and controlled cold exposure. Cold water helps with blood ventilation, increases the number of white blood cells and makes us more alert.
Lastly, I will present the various studies that have proven Wim's claims to be true and how the method can be applied to help patients with various auto-immune diseases.
Follow me, as I explain why I believe this method could change the way we look at our own health, strength and happiness forever.

SP61. IDENTIFICATION OF MECHANISMS AND FEATURES OF COLOR FORMATION BASED ON THE MEASUREMENT OF THE TRANSMISSION SPECTRUM OF DYES IN WATER SOLUTIONS

Maksim Turovski
Tartu Annelinna Gymnasium, Tartu, Estonia

Man interacts with the environment using his senses: smell, touch, taste and hearing. The most important thing is vision – the ability to perceive information by converting light signals of different wavelengths into contours and images of different colors. Visible radiation, or visible light, is called electromagnetic radiation with wavelengths of 390 - 750nm, which is perceived by the human eye and is formed as color sensations. The author of this work studied the features of transmission spectrum using colored water solutions as an example.
The studies were carried out on a computer-controlled, double-beam spectrophotometer which allows recording absorption and transmission spectrum with a low noise level in the range from 190 to 900nm. The author conducted measurements of the transmission spectrum of a green water solution, a blue water solution, a yellow water solution, a red water solution, a black water solution, a mixed solution of yellow and blue color, mixed solution of red and blue, mixed solution of green and red, mixed sample of all colors.
The study of the spectral characteristics of water color solutions (close to transparent) revealed several features that are unique to them: the mechanism of the appearance of simple primary colors, the mechanism of a combination of various intervals of wavelengths of light with the appearance of new colors and complex shades, competition and dimming of colors up to black in complex color solutions.

SP62. INVASTIGATION OF THE RELATIONSHIP BETWEEN THE COLOR OF AN INCADESCENT LAMP, THE EMISSION SPECTRUM AND THE FILAMENT'S TEMPERATURE. OR ELSE, WHAT IS THE SURFACE TEMPERATURE OF A STAR?

Miltiadis Raptis, Agrippina Margaritou
Geitonas School, Sternizes Koropiou, Athens, Greece

The laboratory investigation that is presented in this paper explores the relationship between the color of an incandescent lamp, its emission spectrum and the temperature of the lamp's filament.
An incandescent lamp and a spectroscope will be used to collect experimental data. The data collection is going to take place in two stages. Initially the electrical circuit will be used for measurements of potential difference and electric current, in order to calculate the corresponding electric resistant.
By using relevant theoretical notions we will calculate the resistivity of the filament's material and the corresponding temperature of the filament. In the next experiment, by using some of the values of the electric current, we will observe and record the lamp's filament color. Then, for those values of electric current with the use of spectroscope, we are going to analyze the lamp's light emission spectrum. Finally, by combining data from the two experiments we aim to correlate the color of the filament lamp with its emission spectrum and its average temperature.

SP63. ELUCIDATING THE MYSTERY OF STARS AND BLACK HOLES

Maria Nicolaides, Kosmas T. Papadopoulos
American Academy Larnaca, Cyprus

Black holes are one of the most prodigious mysteries of the universe. Even the world's top astrophysicists can only theorize about how the black holes evolve and all their different features. This presentation aims at encouraging science students to search the answers to the unknown of this astrophysics phenomenon. We explore the life of stars, their journey and remarkable death, which, in turn, leads to the development of a vast black hole. The different stages in a star's life are mentioned and explained, considering the different masses of stars. Emphasis is placed on the first stage of nuclear fusion, and how new elements are formed from existing atoms. Also, two central features of black holes are discussed, namely, the event horizon and its conical shape ending in the singularity. We discuss the colossal, supermassive black holes in the centre of each galaxy and focus on the only existing photo of a black hole, that of the SMBH of galaxy M87. The presentation ends with a discussion about how black holes die out through the process of Hawking Radiation and how the last black hole is thought to die in a googol year (that is after everything else in the universe has died).

SP64. DOES TIME EXIST?

Tatiana Pelecanou, Demetra Efstathiou, Mary Efstathiadou, Despina Michaelidou
American Academy Larnaca, Cyprus

Did it ever occur to you if time actually exists, or if it is just an imaginary human invention created to help them in their lives? This presentation will demonstrate a clear solution to the enigma of time which brings to light the reason behind many predictions of Special and General relativity such as why time slows down with motion and in gravity or why objects gain mass when accelerated by a force but not when falling in gravity. When you first think about it the answer is obvious; time exists. However, we are going to make you believe otherwise by explaining the theory of physics behind this simplistic but rather confusing statement. Time is defined as the indefinite continued progress of past, present and future existance and events. But what if it had no independent existance; it may just be a common unit of motion making the world that is constantly changing easier to describe. Questioning the existance and meaning of time has become rather complex in contemporary physics thanks to Einstein's theory arguing that "time is a mode by which we think and not conditions that we live". Older time measurements heavily depended on observations of changes of weather and nature (day to night and season to season) to build calendars. However, more precise methods eventually came along to put time in more convenient boxes (clocks). A life without time and clocks seems quite unimaginable. Find our more exciting information during our presentation.

SP65. SPACE EXPLORATION

Tarek Abd El-Aziz
Yahya Kemal College, North Macedonia

I will be talking about space exploration in the coming decades, with all of the exceptional advancements in rockets we have opened the door for extraordinary space journeys and opportunities for space exploration. From inter-city rocket travel to the colonizing of mars, the following decades hold a lot of exciting moments. Currently many competitive companies exist in this field of science, nobody has been this excited about space travel since the space race in sixties. So, we can easily say that space travel is livelier than ever before. The biggest breakthrough we had in these years is reusable rockets, thanks to SpaceX what was once science fiction is now reality, now rockets can land upright and all that separates them from their next flight is refueling. SpaceX has many more incredible plans, such as building the BFR the biggest rocket in history that will take humans to mars or Starlink the web of interconnected satellites that will broadcast the internet to every corner on Earth in the future. As I said a lot of astonishing moments await us! Moreover, it is not just SpaceX thrusting us into the future, Nasa has countless plans as well. For instance, building a moon base. With all of the competition we are having a modern space race of who advances this technology the fastest. We are building our own future, the future where we are a spacefaring civilization !

SP66. SPACE AND PLANETS

Melina Iacovou, Loukia Stavrou
American Academy Larnaca, Cyprus

We have been fascinated with space and the planets since ancient times. It is part of our human nature to explore and be curious about the world around us. We are determined to ask important questions: are there new lives, new species, new cultures? Where and how can we actually find these new lives? In many early civilizations, planets were thought to be ancient gods. Our names for the planets are still the Roman names for these gods; for example, Venus the goddess of love. As our technology got better, this knowledge has expanded. We now know that we have four inner solar system planets that are terrestrial; two gas giants and two ice giants Uranus and Neptune. In 2006 we stopped thinking of Pluto as a planet and it is now known as a dwarf planet. Therefore, what we know about planets constantly changes, since our astronomers have access to more developed instruments and international teams of scientists work together in space missions. As the climate of our planet changes and as our resources will not last forever, discovering new planets will be important for humanity to survive. But until we really have to relocate to other planets, we can look at them from the comfort of our own. Telescopes on earth or Hubble in orbit around the earth, as well as images from the International Space Station or other space missions all add to our understanding what planets are and why we need to explore them.

SP67. ENO-CARPOLOGICAL STUDY OF GEORGIAN VINE SPECIES PROTECTED IN GEORGIA AND EVALUATION OF THEIR ANTIOXIDANT PROPERTIES

Luka Kuchukhidze, Maria Lomaia, Elisabed Martiashvili, Lizi Kuprashvili
Tbilisi International School, Georgia

The Georgian Vine gene pool contains about 525 local varieties whose oenological quality is determined by biochemical characteristics, where phenolic compounds are important, as well as their antioxidant properties, their study is being important, for optimizing winemaking technologies and for evaluating antioxidant quality. At present, the characteristics of the phenolic compounds of most Georgian vine varieties are poorly studied.
The purpose of the research was to study the eno-carpological characteristics of Georgian vines, to characterize the genome, to evaluate their oenological and antioxidant potential.
Research shows that the amount of extruded polyphenols, extracted from grape juice is significantly lower than that of grape skin. The studied varieties are characterized by high content of antioxidants, in particular phenolic compounds. Georgian grape varieties are characterized by Anno-karpological marks, which is more interesting in less spread varieties to characterize its potential.

SP68. THE ROBOTS KINGDOM IS NEAR

Dimitris Papamiltiades, NickyHadjigeorgiou, Antriana Kranidioti, Giannis Marmaras
Lyceum A' Ethnarchis Makarios III

For years now technology has played a big role in our lives. We have seen multiple investments but nothing comes close to robots. Robots have seen a huge development in the past few years, and are most likely to take over the future. Everyone has been dreaming for the day that robots are going to facilitate and enhance people's daily and professional spheres, even more that they already have, proscribing humans from risking their lives or from fighting to achieve what robots can do in a nick of time. Robots have already been a part of many disciplines and fields and they will continue to play an even more critical and dramatic role in the near future. They have affected learning, medicine and many other fields, which has brought us to the moment where robots can actually save people's lives. Robots have so far solved many problems that mankind faces but the question remains: will they be able to bring an end to the biggest threat humans face, the destruction of the environment? The robotics science contribution to all the aforementioned fields appears to provide promising solutions to this major issue.

SP70. PLASTIC POLLUTION: WHAT IS NEXT?

Alberto Mparkis, Sotiris Panagakis, Christina Papaefthimiou,Marios Pantazopoulos
Supervisors: Lina Chachali, Eirini Siotou
Nea Genia Ziridis, Greece

Plastic products are very common in our modern life. According to estimates, every year we use approximately 1.6 million barrels of oil just for producing plastic water bottles. Plastic waste is one of many types of waste that take too long to decompose. Normally, plastic items can take up to 1,000 years to decompose in landfills. Even plastic bags we use in our everyday life take anywhere from 10 to 1,000 years to decompose, and plastic bottles can take 450 years or more.
In this presentation we will introduce ways of reducing plastic pollution, which is nowadays one of the most pressing environmental issues, as rapidly increasing production of disposable plastic products overwhelms the world's ability to deal with them. Plastic pollution is not only visible in countries, where garbage collection systems are often inefficient or nonexistent, but in every corner of the world.

SP71. GYROSCOPIC ROTATION

Kyriakos Dodson, Oliver Williams, Joshua Bryans, Parisinos Cavaye
International School of Paphos, Paphos, Cyprus

In 1852, a French scientist called Léon Foucault invented the revolutionary Gyroscope. The reason why the invention of the gyroscope was revolutionary was simply because it could measure the orientation and angular velocity of an object. It also showed the principle of gyroscopic rotation being the movement of a rotating object to keep the orientation of its rotation. However, this momentum must be maintained. The object will resist any change in its axis of rotation. Gyroscopes are not the only objects that can show the principle of gyroscopic rotation, for example, when thrown, modern yoyos spin around 7,500 to 8,000 RPM, meaning that when thrown a modern yoyo tries to keep its angular momentum constant. That's why it feels strangely stable as it spins on the string. It feels almost as though it has a built-in stubbornness setting. having said that, what is gyroscopic rotation used in? gyroscopic rotation is used in man things, such as inertial navigation systems with airplanes and spaceships. It also can create problems with flywheels. It can cause catastrophic failure in wind turbines.

SP72. TIME IS RELEVANT OR ISN'T IT?

Elena Mantzouka
Supervisors: Lina Chachali, Eirini Siotou
Nea Genia Ziridis, Greece

Time is such a fundamental concept: "I am running out of time", "time flies", "I am getting older", "the time for the meeting", "give me some time". We use the word time in countless situations but do we really realize the physics behind the word? In this paper we will investigate many aspects of the concept of time. When did we start measuring time? Einstein said "time and space are not conditions in which we live but modes by which we think" whereas Carlo Rovelli mentions "The strong emotion of time is what time is for us". Finally, we will argue about the rhetorical question: Is time an illusion or not?

SP73. ROBOTS TAKE CONTROL

Danai Fragki
Supervisors: Lina Chachali, Eirini Siotou
Nea Genia Ziridis, Greece

The past few years the revolution of technology has altered the way we see the world. Some researchers claim that it is only a matter of time till robots are used to substitute humans and replicate human actions. According to them robots will be able to think, work and create like humans. Behind these impressive functions lies an ocean of Mathematics. In this paper we made a historical review of the correlation between Mathematics and Programming. But what is coding? Coding in robotics is essentially written instructions that a robot can read and execute. These instruction can be written in various programming languages such as C or C++. In our research we will introduce the basic principles of statistics, Calculus and Algebra needed to program a Mindstorm robot. Afterall, some researchers strongly suggest that robots will take over the Earth. We just don't know when.

SP74. RENEWABLE RESOURCES OR PLANET DISASTER?

Georgios Chrysou, Daniela Felouri
Supervisors: Lina Chachali, Eirini Siotou
Nea Genia Ziridis, Greece

Various researches among the world claim that the ecological disaster of our planet can be avoided with the use of renewable sources of energy. These sources include hydropower, geothermal power, wind energy, solar energy and biomass energy. In our research we have developed a simple model of production of wind energy.
In this small hydroelectric project (up to 10 MW) we make use of falling water in order to generate electricity or to convert it into usable mechanical energy. Using the data derived from our model we make a statistical research and use the results in order to present a future plan for more economical sources of energy. Last but not least we argue about the way we will find the right method of using renewable resources as

SP75. HOW TO YOU FUND YOUR GENES?

Arian Adeli Koodehi
International School of Paphos, Paphos, Cyprus

Lung cancer is ranked the deadliest cancer with 154 thousand deaths in 2018 alone. It is funded more than most diseases, yet it is classified as underfunded. Lung cancer is funded just below 2500$ per death making it the least funded cancer and the 4th least funded disease. Although it is usually brought upon people by themselves, from smoking, pollution and passive smoking can also contribute to the increasing numbers of people being diagnosed with lung cancer. In diseases such as Hemophilia or Angelman syndrome (AS) which are rare genetic disorders, the individual was simply unlucky and was born with it receive much less funding. These are very uncommon compared to lung cancer and nowhere as deadly, so the funding per death-a measure used to compare funding- for these diseases is higher than lung cancer, therefore, lung cancer will still be classified as underfunded and prioritized over the others. If you compare the funding for both cases, lung cancer is funded remarkably higher than the other two, but they are not ranked as an underfunded condition. So why do we allocate such little funding to genetic diseases compared to a condition which is a result of the persons actions?

SP76. BACTIRIOPHAGES

Dasia Razumova
The Senior School, Nicosia, Cyprus

Our time with antibiotics is running out. Antibiotic resistance is one of the biggest threats to global health, food security, and development today and can affect anyone, of any age, in any country. It's been estimated that antibiotic resistance could cause 10 million deaths each year by 2050 and cost €77 trillion. In the last 30 years no new antibiotics were discovered to enter the race with antibiotic resistant bacteria. Therefore, the emergence of antibiotic resistant bacteria resulted in renewing interest of alternatives like "Bacteriophages", the natural enemies of bacteria. They were discovered in 1915 and 1917 by two scientists working independently from each other. Bacteriophages are viruses that infect and kill only specific bacteria. There are many advantages in using bacteriophages, for example by owing to their host specificity (the strain of the bacterium they feed on) they minimize the impact on health-protecting normal flora bacteria. Moreover, bacteriophages act using mechanisms that differ from those of antibiotics, therefore it is more difficult for bacteria to develop phage resistance. There are now clinical trials of phage-therapy products underway in the U.S. and in Europe. If successful, this could be our greatest weapon to win this race.

SP77. LIFE AND WORK OF ISAAC NEWTON

Zenonos Andreas, Ellinas Pavlos
Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus

"I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me."
Isaac Newton
In this research project, I attempt to present the life and work of a great physicist, mathematician, astronomer, philosopher, alchemist, and theologian, Isaac Newton. During the research process, I studied articles, online journals, books, and websites, in order to get to know, to understand and present the importance of Newton's contribution to science. My research led me through the years that he lived, I studied the conditions and the course of his life, I discovered the influences he had on creating the enormous work that he left behind, and I understood the three monumental laws of motion.
Through this journey, I felt the value of physics in our lives and marveled at the love and dedication of this great human being in researching and studying our world.

SP78. THE WORLD THROUGH THE EYES OF AN ANIMAL

Anna Panagiotou
Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus

In their everyday life, people use their eyes to see different objects, observe other people's reactions, watch movies or enjoy the nature. Therefore, it is crystal clear that human eyesight plays a significant, if not a dominant role in their daily routine. But have you ever wondered how the world looks like through the eyes of an animal? Starting with a brief reference to the eye structure, as well as the whole mechanism of human vision, man can inform about several important terms that are useful in recognising the differences between the human and animal visual system. Additionally, humans and animals will be divided into different groups according to their special visual features (such as the exact location of their eyes on the skull, the number of pictures they get at a time, the types of photoreceptors they have - which define the wavelengths they get/colours and the ability of night vision, etc). Moreover, the main part of the presentation includes a list of the animals with the most advanced vision, as well as the special eye structures they have, which enable them to differ from the other animals and become exquisite predators. Last but not least, there will be a quick reference to some of the most significant studies, which took place in the sector of visual physiology and the final results of these researches.

SP79. THE WEIRDEST PYSICAL PHENOMENA

Marilena Alexandrou, Anna Andreou, Kyriaki Neofytou, Artemis Katsonouri, Natalia Constantinou
Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus

Earth is an amazing place with many natural surprises that amaze us. Outside our door, there are unbelievable things that happen in nature, which we don't see every day. Some of these phenomena are rare and incredible, but they really happen. Apart from these, the strange and particularly happening things, will make you appreciate more the wonderful planet we live on. By natural phenomena we mean any change in the in the physical condition of a body under any conditions or forces that affect it. At the same time, this term also means the physical change of a body. A natural phenomenon is not an engineered event manufactured by humans, although it may affect them. Most natural phenomena, such as fog, are relatively harmless so far as humans are concerned. Various types of natural phenomena occur, including the following: *Geological phenomena, *Meteorological phenomena, *Oceanographic phenomena. In our presentation we are going to introduce 6 of the weirdest natural phenomena that exist in our world.

SP80. A MATHS PILL

Amoriello Pietro, Bovino Stefania , Iannella Alessia
Liceo Scientifico "G. Rummo" Benevento, Italy

Mathematics and medicine have always been two related sciences: just think of the many mathematical aspects that are applied in the medical field. Nowadays the development of technology has also led to a greater rapprochement between medicine and mathematics. When we talk about mathematics and medicine we have to talk about mathematical model. We all have a little bit of mathematics in our blood, and we have several formulas available to help us calculate and quantify some of the different factors that make up our blood. Medicine dosing plays an important role in medicine. At its base we find several examples of how mathematics, in particular proportions, help in medicine distributions. Moreover, drugs such as morphine for pain therapy are also often used in medicine. We have therefore created diagrams to describe and compare the doses of morphine and those of a classic medicine. We find an application of mathematics also in the work done by the left ventricle of the heart.

SP81. STARS, EMBRYOS, AND THE UNITING POWER OF ALGORITHMS

Janat Derawi, Noor Farid
Mediterranean High School, Larnaca, Cyprus

An algorithm is defined as 'a procedure for solving a problem based on conducting a sequence of specified actions,' or simply put is a set of instructions used to perform a specific task. The word algorithm was first thought to be defined in the 9th century by the Persians but is believed to have been used thousands of years prior to this. What is indisputable is the importance of algorithms in our modern day, computerised lives.

One area of science that utilizes these sequences of instructions is astronomy, particularly in the study of the development of galaxies. However, who would ever think that the exact same algorithm used in the study of the stars could explain a key feature in the development of mammal embryos?

As embryos develop, they follow predetermined patterns of tissue folding, which allows flat sheets of cells to become important shapes for body parts. The ability to continuously repeat this tissue folding is generated by a network of proteins that connect like a fishing net, creating many alternative pathways that tissues can use to fold the right way.

Two scientists, Adam Martin and Jörn Dunkel, found that the algorithm used in astrophysics to map connections in galaxies, could similarly trace the protein networks across and between the cells in a sheet of tissues. The scientists also discovered a mechanism in which alternative pathways could be made if many of the cells in the network are damaged.

In our presentation we will describe this unusual marriage of mathematics and biology and in the process highlight the importance of collaboration between scientists in different fields.

SP82. THE BOTTLE FLIP

Shana-Maria Gossoub, Dariia Khudobiak, Ceren Semiye, Noa Alessia Phil, Naomi Gonzaga Gerber, Olga Georgiou, Caelan Jackson Byrne
Grade 6 Med Junior School, Cyprus

In May 2016, a senior high school student called Michael Senator created something called a bottle flip. Bottle flipping is a trend that involves throwing a plastic bottle, typically partially full of liquid, into the air so that it rotates, in an attempt to land it upright on its base or on its cap.
Water bottle flipping involves taking a plastic water bottle that is partially empty and holding it by the neck of the bottle. Force is applied with a flick, with the bottom of the bottle rotating away from the person. If performed successfully, the bottle will land upright. Additionally, the bottle may land upside-down, or on its cap. Doing this is significantly more difficult than flipping a bottle so it lands upright.
The amount of fluid in the bottle greatly influences the success of the feat, and it has been shown that filling the bottle about one-third of the way improves the rate of success. In our presentation we will be showing how by carrying out various experiments how much the optimum amount of water is needed for successful flipping.

SP83. FOOTBALL MATHEMATICS AND PHYSICS

Bruna Plese
Prva rijecka hrvatska gimnazija, Frana Kurelca 1, Rijeka, Croatia

Football is one of the most famous sports in the world. Although it seems simple, it is a sport that needs tactics because it is closely linked to mathematics and physics.
Football fans might develop love towards mathematics and physics through a scientific explanation of the sport. If you want to watch football, you need to know some arithmetic operations that have natural numbers, a percentage account with rational numbers. Also important is to be able to determine the team ranking by comparing results. Physics is perhaps more closely related to football than mathematics. Pressure is perhaps the biggest contributor to it.
In this presentation you will find out the detailed connection between football and these sciences and how to get people to understand and appreciate them.
Croats are quite successful in sports, especially in football. It might be the reason that we developed good game strategies and tactics because we are also good in mathematics and physics.

SP85. STOMACH ULCER

Eftychios Malialis, Michalis Panagiotou, Yiangos Michael, Petros Petrou, Prodromos Xrisostomou
Lyceum A' Ethnarchis Makarios III, Paphos, Cyprus

As we all know the human body is a magnificent vessel of our soul but, what happens when suddenly you are suffering from a stomach ulcer. It is known that the human body has many systems but one of the most important especially for our survival, is the digestive system. What is more my team has decided that we needed to investigate further into this system and more importantly a negative aspect which ultimately leads to a painful stomach ulcer, or other way known as gastric ulcer. We have looked at its symptoms and we have found one of many ways to treat it with a specific pill which is an antioxidant drug and with a little help from chemistry we can tell how many pills you might need for the treatment and why.

WORKSHOPS

WS1. LET'S DISCOVER MATHEMATICS WITH DIGITAL TOOLS

Mara Grasic, Osnovna Skola “Braca Radic”, Croatia
Ksenija Varovic, Osnovna Skola Fran Koncelak Drnje, Croatia

The advancement and development of technology has a significant impact on every part of our daily lives, including our education system. Information and communication technology has become an integral part of education. To students, digital environment is something natural. With the help of digital tools, students' level of motivation rises, their interests are actively developed and studying is made easier for them because every student has a chance to solve tasks at their own pace and in a controlled environment.
We have a wide range of digital tools available to us that are simple to implement into school environments. It is important to note that these tools encourage students to develop their creativity, critical thinking, research skills, and collaborative and independent learning skills.
In this workshop, students will actively participate in activities designed using these digital tools. Each and every tool offers new opportunities for creativity, connecting and inclusion in a more authentic way to learn.

WS2. PRACTICAL APPLICATION OF LINEAR DIOPHANTINE EQUATIONS WITH TWO UNKNOWNS

Sava Grozdev
VUZF University, Sofia, Bulgaria

Several problems will be considered for time measurements by sandglasses and liquid pouring. Solutions will be discussed applying linear Diophantine equations with two unknowns. The workshop will be suitable for 5-8 grade students.

WS3. ORNAMENTS: ALGEBRA MEETS GEOMETRY

Tomasz Szember
Pedagogical University of Cracow, Poland

The workshop is addressed to students from grade 9 on (15+ years old)
and mathematics teachers.
This workshop is motivated by works of Conway and Coxeter. They have discovered
that certain patterns of numbers can be related to geometrical properties of polygons.
As the results are quite surprising and in order to avoid spoilers, this abstract does not
reveal more. Interested? Then come, participate and understand!

WS4. ARE LINES STRAIGHT (FORWARD)?

Justyna Szpond
Pedagogical University of Cracow, Poland

The workshop is addressed to students from grade 6 on and mathematics teachers.
We will be working with configurations of lines and points on the plane. They have many interesting properties and I hope we will find some of them.

WS5. KAHOOT QUIZ

Marina Furkes, Bojana Habek
Gimnazija “Fran Galovic“ Koprivnica

Students will test their knowledge in maths and science by playing a Kahoot Quiz. Teachers decide how much time students have to complete the tasks and answer the questions. The questions will of course contain math and science problems. For this game every group of students needs to have one smartphone with an internet connection There will be 2 quizzes prepared, one for primary school students and the other for secondary school students. Each will last about 20 minutes (together 40 minutes). To join a game, students need a unique PIN that will be writen on the screen and questions are displayed on a shared screen. Speed is also important because the faster group gets more points. At the end, the group with the biggest score wins and gets a small price. This activity is great for team building activities, and for students just getting to know each other. We hope both the students and the teachers will have lots of fun.

WS6. PARTICLE PHYSICS (ELEMENTARY). PLAYING WITH THE QUARKS

Prof. Evangelos Gazis
NTUA-IASA

There will be an introduction of the fundamental building blocks of the matter, the quarks and the leptons. A simple software game will be loaded to the laptops of the students, so they will be able to add various quarks for composition of baryons (three quarks) and mesons (quark-antiquark). Additional knowledge of the students will be the understanding of the matter and the anti-matter plus the dark matter.

WS7. PARTICLE ACCELERATORS. THE MACHINES OF THE FUTURE

Prof. Evangelos Gazis
NTUA-IASA

The evolution of the accelerator machines for charged particles, starting from the cathode ray tube used by Joseph John Thomson to discover the electron (1897), awarded Nobel Laureate in Physics (1906) to the Large Hadron Collider - LHC at CERN, having 27 km perimeter and an extraordinary center of mass energy of 14 TeV (1012 eV) with superstitious unique luminosity of 1032 protons per cm2 and sec-1, will be presented, well described in the Livingston plot. In addition, the major applications of the accelerator machines: linear and circular, with electron- or positron- or proton- beam and intense monochromatic X-rays will be analyzed from the environment to energy, industry and medicine for the cancer diagnosis and therapy.

WS8. DENTAL MATH

Nikolina Kuzmić Šelimber, Hrvoje Šelimber
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Osnovna škola “Antun Nemčić Gostovinski” Koprivnica, Školska 5, Croatia

In today’s fast-paced lifestyle, people have little time to actively think about their health. One of the important things for normal living and functioning is oral health. Research indicates that in some countries, Croatia included, a concerning number of children and adults have cavities and problems with oral health. Therefore, it is important that we teach kids from the youngest age about proper oral hygiene for them to have less problems later in life.
Although it may not look like this at first, there’s a strong connection between math and teeth. With the help of math and many different types of math tasks we can encourage students to think more about proper oral hygiene and oral care. With the number of teeth, seating of an individual tooth in a jaw, symmetry and many other possibilities we can design various math tasks in which, including solving mathematical problems, students can also learn about teeth. Proper teeth brushing and time that we spend brushing them are topics that can be incorporated in math.
In our workshop we will show how to design tasks which involve performing calculating, solving equations, filling the dots in the coordinate plane and rehearsing other parts of a math curriculum for elementary schools, all relating to teeth and oral cavity. Besides learning math, our goal for students is to gain new knowledge about their teeth and realize the true importance of proper oral care.

WS9. SOLVING PUZZLES AND RIDDLES USING LOGIC AND PROBABILITIES

Michalis Gavrielides
The English School, Nicosia, Cyprus

The use and study of valid reasoning otherwise called 'logic' is many times used in our everyday life for making up decisions that some people consider rational and some don't. When though it comes to the solution of a puzzle or a mathematical problem logic is the tool to help ending up with the correct solution which most of the times is unique. Using the logic ourselves, throughout this workshop, we will attempt to solve the Cheryl's birthday puzzle which went viral in 2015 and also the famous Einstein's riddle which according to him it can be solved only by the 2% of the population. Logic as a tool can be proved very powerful especially when it is combined with some basic principles of probabilities. Have you ever wondered what is the probability that you have been born on the same day of the week with a stranger and why? Or even considering more complex probabilities have you ever thought about the odds of sharing a birthday with one of the n students (Birthday problem) in your classroom or year?

WS10. THE UNIVERSE GOES TO PRIMARY SCHOOL

Elena Elliniadou MEd
2nd Primary School of Piraeus Uruguay, 50 Karaiskou str., Piraeus, Greece

How do scientists think?
How do planets orbit around the Sun?
Can we make clouds, sunset and sunrise with water and milk?
Do balloons show the expansion of the Universe?
Where is the rainbow in the classroom?
How does powdered sugar shows the collision of protons?
Can we take a cosmic funnel home?
Is there evidence for climate change?

These and many more questions are going to be answered in the European Student Conference Euroscience 2020 STEAM workshop for students aged 11-14, in Thessaloniki, 11-15 March 2020.
The workshop will be conducted by 6th grader students from 2nd Primary School of Uruguay in the context of the innovative educational program "the Universe goes to Primary school" that runs in our school on Science, Astronomy, Modern Physics, Mathematics, Engineering and Arts.
It is a STEAM project that gives ideas and answers to students curiosity, creativity, problem solving, critical thinking, collaboration and other 21st century skills, students should acquire in school. (Workshop duration 90 minutes).

WS11. HOW MANY DESCENDANTS?

Brendan McLoughlin
International School of Moscow, Russia

In 1900, Lester Milbrath estimates the global population to have been at around 1.6 Billion (Milbrath p14,1989). This figure massively contrasts with the 7 billion milestone that the population reached in October 2011 (Haugan p43, 2012). So how did the population increase so rapidly in so short a space of time? The United Nations have reported being concerned (Ebden, 2011) by the sustainability of the logistic growth that the population seems to be experiencing.
In this workshop, students will be shown a black and white photograph of a nuclear family from 1900. The overarching question students will be seeking to answer is how many descendants are still alive today from this family today. Based on the photograph, students will make a series of assumptions with regards to the family's background and the relevant characteristics of the members in the photograph.
Presentations will then be prepared in groups on A3 paper to make mathematical and historical cases for how many descendants this family may have that have survived to this day. These presentations will then be put to the whole group. At the end of the workshop, the group will vote on which presentation was the most compelling.
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WS12. GENES AT WORK. A BOARD GAME TO WORK ON RELATIONSHIPS, ETHICAL SKILLS, STRATEGIC THINKING, PLANNING, COOPERATION, AND INCLUSIVENESS

Di Fonza Mario, Nappi Sabrina, Busiello Rosanna, Puzone Giuseppe, Settembre Vincenzo, Aiese Rosa Krizia
Istituto Statale per l'Istruzione Secondaria "Europa", Pomigliano d'Arco, Naples, Italy

Neither teachers nor students like boring lessons. That is the reason why we decided to create a board game concerning unpopular subjects, such as mathematics, physics and biology. In our opinion a game may develop curiosity, interest and desire to deepen into specific topics.
Central cores of the game are the genetic code and the Vigenere's code, evolutionary stage of today computer science. It is a full-immersion in the boundless theme of "transformations", declined in an evolutionary sense, in changes of state, in system conversions and more. The aim of the game is to conquer one evolution protein that is represented with a "protein" card, which each player draws at the beginning of the game. The first to conquer all the amino acids contained in his protein card wins. Players are challenged with encoding and decoding activities, with "contentions" and with the timeline.
The students had an absolute leading role in the creation of the game. We choose a series of proteins representative of every living species on earth, respecting a chronological order of appearance. We started from the very first organisms present on earth. The purpose of the game is to understand that the evolutionary steps are linked to a different combination of amino acids that form a different protein.
The game is strategic, casual, fast, formative and inclusive. We are convinced that the creation of "Genes at work" has been crucial in the creation of relationships, ethical skills, strategic thinking, planning, cooperation and inclusiveness.

WS13. AN EDUCATIONAL AND INCLUSIVE APPROACH OF GEOMETRY THROUGH FRACTALS

Anna Alfieri
Liceo Scientifico "Luigi Siciliani" Catanzaro, Italy

The development of geometry has a significant role in understanding, describing, and interacting with the space in which we live. In education, Euclidean geometry has been considered an important part of mathematics in K-12 and college in countries all over the world. Learning Euclidean geometry helps students to recognize the various regular objects and to develop their logical thinking through learning its deductive and logical system. However, Euclidean geometry does not explain the irregular shapes and objects that occur everywhere in the world. What are the structures of blood vessels, river networks, spirals, etc.? What is the length of a coast line? These questions cannot be answered until mathematics teachers have a good grasp of a new geometry language and approach, which is named fractal geometry. Introduced by Benoit Mandelbrot (1977), it has become well established as a new subject in mathematics. Fractal geometry provides a new way to think about geometry in an inclusive way:
1) the applications of fractal geometry can be found in many fields: art, astronomy, nature, computer science, fluid mechanics, telecommunications, surface physics, and medicine, among others. Fractal geometry connects many mathematics concepts in the secondary math core curriculum
2) Fractal problems can also be used for motivating students to conduct inquiry studies/active learning, inspiring students to discover novelties, and increasing interest in learning.
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WS14. USING MATHEMATICS TO SAVE WATER

Amélia C. Caldeira(*), M. T. Malheiro(**), Rui M. S. Pereira(***), A. Manuela Gonçalves(****), S.O. Lopes(*****)
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Climate change is a reality that is increasingly affecting our daily lives. Long periods of drought and rising temperatures damage agricultural production due to water scarcity. It is a priority to make the population, and in particular the student community, aware of the efficient use of water. Conscious water consumption means voluntary attitude changes that aim to conserve our planet and minimize the impact of water consumption. At the same time, experiments give the opportunity to show, through concrete cases, how mathematics can model natural phenomena to better understand them and predict future behaviors. In particular, we aim to show how mathematics can be a valuable tool for understanding the infiltration of the water in the soil.
In this workshop, we intend that students have the ability to enjoy mathematics, recognize and value its role in the sustainability of our planet.
The students will study the behavior of water infiltration in different type of soils; they will compare real data with mathematical models and verify the veracity of the model using mathematical tools.
This workshop is a “hands-on” on experiments about the water behavior in different soils and its mathematical model.

WS15. MUSICMATH METHODOLOGY: FRACTIONS ENSEMBLE

Eric Roldan Roa, Erika Roldan Roa, Misael Hernández Leal, Aldo Martínez Chávez
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Fractions Ensemble Workshop offers a captivating and ludic approach to learn fractions and proportions. During the workshop, students understand how these mathematical concepts are connected to music and how they could use math to describe compelling musical rhythms. Students engage in diverse activities, including collaborative learning exercises, that will end with a final artistic performance. This workshop incorporates the use of technology that has been developed and/or adapted by the MusicMath team with one objective in mind: to give the students a meaningful experience in which they can grasp fractions and proportions through listening to and playing the mathematics behind them.

WS16. BOOSTING CIRCULAR ECONOMY KNOWLEDGE IN STEM FUTURE CLASS

Eirini Siotou*, Effie Papageorgiou**, Lina Chachali***
*MSc., Head of the Science and R&D Department, Blooms pilot teacher, Physics teacher, Nea Genia Ziridis
**Phd, Chemistry teacher, Blooms pilot teacher, Nea Genia Ziridis
*** MSc., Vice-principle, Mathematics teacher, Nea Genia Ziridis

Are you a teacher interested on learning how you can explore sustainable economic solutions with your students? Then get ready for the BLOOMs Project! In collaboration with the European Schoolnet, the BLOOM project is inviting primary and secondary school teachers of all subjects to use bioeconomy as a way of engaging pupils in school subjects. Knowledge about bioeconomy is an essential requirement for students of the 21st century. Not only will the bioeconomy sector provide the jobs of the future, this knowledge will help your students better understand the challenges of tomorrow's society and enhance their skills as responsible citizens. Bioeconomy covers a broad range of sectors, from agriculture and the agri-food industry, to fisheries, forestry, bio refineries, chemistry, and (bio) energy – but despite its many applications, it has yet to enter the public consciousness as an exciting solution to societal challenges. Teachers can contribute to raising awareness about bioeconomy in future generations.
Overall, this workshop aims on giving teachers a fresh perspective into the bioeconomy field by introducing teaching resources that have been developed, implemented and tested by STEM pilot teachers from schools from ten different countries (Greece, Austria, Spain, Sweden, Poland, Italy, Belgium, Portugal, Israel, Croatia).

WS17. MathTriathlon

Kostis Andriopoulos* and Nikos Papadopoulos**
* The Moraitis School, Athens, Greece,
** The Senior School, Nicosia, Cyprus

Create a team of 3 students (the Math-triathletes are not necessarily from the same school or even country) **and compete against other teams in order to win the MathTriathlon!**
MathTriathlon is an innovative Mathematical competition that involves students to adapt a growth mindset and collaboration skills in order to complete certain tasks assigned to them as a team. Individual skills are equally as important as team communication and cooperation skills.
The competition consists of three Math Games (it is a triathlon after all) that the teams need to complete to the best extent possible: MathRelay, MathBattle and MathSpeed. Each team is awarded points according to the degree of completion of the task, the time of completion as well as the accuracy of the results and resemblance to the initial terms and conditions described by the facilitators. Let the Fun & Games begin!

WS18. EVERY WEEK... MATHS

Anita Grguric, Zlatka Miculinic Mance
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The idea of our workshop is to show how to popularize mathematics among the students
aged 15 to 18. My colleague Ms Miculinic Mance came up with the idea of giving students a different mathematical assignment each week. The assignment is always related to the mathematics used in everyday life. Our workshop will present some of the tasks and the most interesting student solutions. Since these assignments are voluntary and the students are encouraged, but not obliged to participate, we will also present the statistics on number of the student participants and the methods of rewarding the most successful ones.

WS19. MATH TRAILS WITH MATHCITYMAP®

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It is important to bring learning to life, and bring learning outside the classroom. By giving the students the opportunity to get outside, replacing the walls of the school building by outdoors scenarios, and experiencing the outside environment, students can bring learning to life.
One way of experiencing outdoor mathematics is to walk a math trail. A math trail is a walk where mathematical problems can be discovered and solved on real objects along the way. The math trail map guides to places where walkers formulate, discuss, and solve mathematical problems in real life, and with real objects. The project MathCityMap (https://mathcitymap.eu/en/) is a math trail management system, where users can create tasks and trails and share them amongst themselves or with the public to run through its APP.
In this workshop, the participants will do their first steps in the MathCityMap (MCM) world, and also advance in discovering the possibilities it offers. Afterwards, they can developed their own tasks, create new routes, and run them with the other participants.
This workshop is a "hands-on" on MCM. To carry out the workshop, the free MathCityMap APP must be downloaded through the Google Play Store or App Store. In addition, the MCM Web Portal will also be used to design mathematical routes.

WS20. EU-MATHS-IN: MATHEMATICS AND INDUSTRY

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Knowledge has become the main wealth of nations, companies, and people. Investing in research, innovation, and education is now the key-leverage for competitiveness and prosperity in Europe. At the heart and foundation of this challenge, mathematics plays a crucial role as it provides a logically coherent framework to enterprises and a universal language for the analysis, simulation, optimisation, and control of industrial processes. Mathematics is an essential factor in the industrial creation of value and a driving force for innovations, but often, its contributions are invisible in the final industrial products. The use of mathematical techniques gives a competitive advantage to the industry by suggesting innovative interdisciplinary approaches. EU-MATHS-IN is the European network of national networks in industrial mathematics. Its goal is to explore ways of stimulating and intensifying the collaboration between mathematics and industry. One way is to disseminate the successful use of mathematics in industry, research as well as in the educational systems.
This workshop will be organized into two parts: in the first part, we will provide a general introduction to EU-MATHS-IN, followed by a number of success stories of mathematics for industrial challenges, addressing different areas in mathematics as well as different industrial sectors to engage the audience; In the second part, a practical session on industrial mathematics for pupils will be set up.

WS21. INNOMATH (Erasmus + programmme) AS A CATALYST FOR THE STEAME APPROACH

Andreas Skotinos
Vice President of Cyprus Mathematical Society

Presentation of the INNOMATH programme with reference to the main target groups it will cover, as well as to the goals and expected outcomes. Identifying the impact and referring to aspects of its results that can be exploited in the STEAME approach. Specifically, to highlight and report how the program:
Provides access to rich content, based on flexibility, accessibility, scalability.
Provides educational infrastructure that encourages students' development, creativity, innovation, problem solving and experimentation skills.
Provides to them and to educators the opportunity to develop the skills needed to promote the STEAME idea.

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