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12th Middle European Mathematical Olympiad
27.8-2.9.2018 ■ Bielsko-Biała ■ Poland

MEMO

MEMOLETTER

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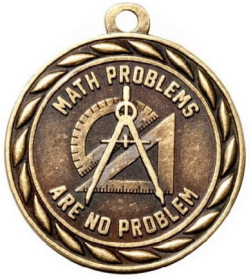
MEMO 2018 Opening Ceremony

MEMO 2011
Individual competition

Let k and m, with $k > m$, be positive integers such that the number $km(k^2 - m^2)$ is divisible by $k^3 - m^3$. Prove that $(k-m)^3 > 3km$.

Can you solve it?



Interview with MEMO contestants

Is it your first time in Bielsko? How do you like it?

Josef (Czech Republic):
I actually haven't been to the town so far, so I don't know yet, but I will see.

Marián (Slovakia):
This is my first time so I haven't been in the city centre yet, but I really like it.

Arsenii (Ukraine):
Yes, it's my first time in Bielsko and in Poland. I feel really great here.

Florian (Switzerland):
Yes. It's good.

Aivaras (Lithuania):
Yes, I like it. I've already seen the town, it's beautiful.

Is this your first international competition?

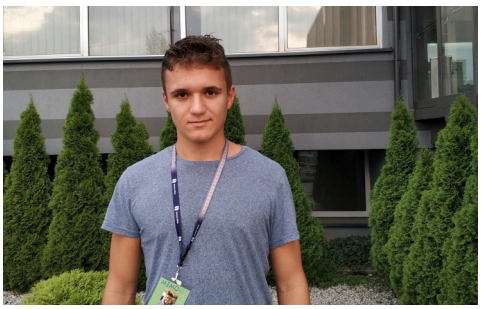
Josef (Czech Republic):
No, I actually participated in MEMO last year and I also participated in an informatics competition.

Marián (Slovakia):
No, I participated in MEMO last year.

Arsenii (Ukraine):
No, I was a contestant of International Mathematical Olympiad two months ago and now I'm the leader of the team.

Florian (Switzerland):
It's even my first time that I'm participating in any Olympiad.

Aivaras (Lithuania):
It's my tenth competition, I participate as a deputy leader and it's a really interesting experience for me, it's just all about mathematics for me.

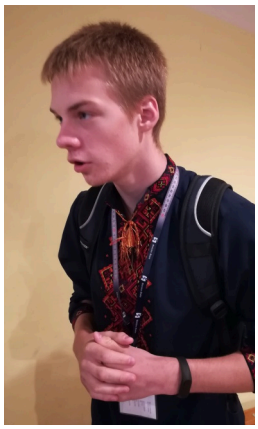


Florian

Josef

Aivaras

Marián



Arsenii

What are your expectations about this competition?

Marián (Slovakia):
I've seen that we have many excursions, so I'm really looking forward to them and I hope I'll enjoy my stay.

Florian (Switzerland):
I'd like to meet a lot of new people from other countries.

Aivaras (Lithuania):
It's usually a great opportunity to see nice places.

The interview was conducted by Aleksandra Haberny a student of High School No 3, Bielsko-Biała

Pi the magic number

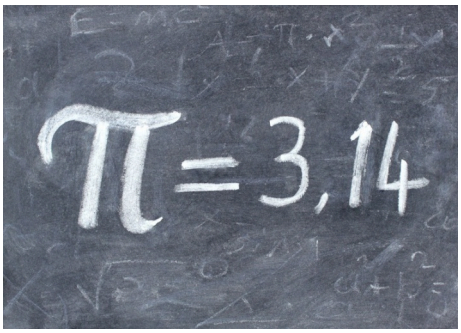
What is Pi?

π is defined as the ratio of circle's circumference to its diameter. The number π is a constant and equals around 3,1415. Pi is an irrational number, which means it cannot be represented as a quotient of two whole numbers.

Why the name?

π is the first letter of the Greek word περίμετρον - perimetron (perimeter). π as a symbol was first used in 1706 by a Welsh mathematician, William Jones in the book 'Synopsis Palmariorum Mathesos', and was later popularised by a Swiss mathematician and physicist, Leonhard Euler. π is also referred to as: Archimedes' constant (using the method of constructing polygons inside and outside the circle, he reached a polygon with 96 sides which gave, in the 3rd century B.C., an average value of 3,1418.) or the Ludolphian Number - named after Swiss mathematics professor, Ludolph van Ceulen who, in 1596, approximated the pi's value to 20 decimal places. In the course of time he expanded his product to 35 decimal places:

3,14159265358979323846264338327950288



Who first calculated π?

In one of the oldest texts of mathematics "The Rhind Mathematical Papyrus" there is a method of calculating a value of 3,16049. The people of Babylon measured the circumference of an inscribed hexagon of a circle, which provided them with the approximation of 3,125.

Squaring the circle

There is an impossible task tied to π which is referred to as squaring the circle. It consists of a (practically impossible) construction of a square with the same area as a circle.

π today

In the 21st century computers approximate π down to the 10^{12} decimal place. In 2014 the record was 13 trillion decimal places of π. The calculations took 208 days of computer work.

Inspirations

Darren Aranofsky made it a hero of his movie 'π'. In Carl Sagan's novel 'Contact' the fragments of binary representation of π are the key to understanding the sense of the universe existence.

"Nobelless" Mathematics

Alfred Nobel's fortune was donated to fund the prizes amounting to 265 million dollars. The sum has been invested up until today, and the and the financial rewards are funded from the profits. The most famous Swede in the history, in his last will, mentioned the disciplines that, according to him, were most important to humanity's wellbeing. Mathematics which, at the time, was more of a philosophical than natural, did not make it into that honourable list.

The Gossip

There are at least a few sensational stories about supposed reasons that lead Nobel to refrain from establishing the prize. In most of them the leading role is given to a Swedish mathematician who lived at the turn of the 19th and 20th century — Magnus Gustaf Mittag-Leffler. He was said to have seduced Nobel's wife... except that Nobel was never married! According to a different, more plausible story, both gentlemen had feelings for the same lady, but she chose the mathematician. As an act of revenge, Nobel rid not only Mittag-Leffler, but all the mathematicians of a chance to win the prize. Another version mentions the name of Sophia Kovalevskaya in Swede's place, a Russian lady also referred to as 'the princess of mathematics'. Thanks to Mittag-Leffler's recommendation, as the first woman in the history, she got the position in the mathematics departament at the University of Stockholm, and shortly afterwards, became a professor. Kovalevskaya, who was more than ten years older than Nobel, was as talented as she was beautiful, which didn't escape Alfred's attention. By rejecting Nobel she was told to have brought over his retaliation on all the mathematicians.

Non-Mathematical Nobel Prizes for mathematicians

The lack of a separate prize in their field did not stop the mathematicians from getting the Nobel Prize. In 1950 the Nobel Prize for Literature was given to Bertrand Russel — a philosopher, essayist, mathematician, and creator of Russel's antinomy. In 1994, for his research on the game theory, the economic Nobel Prize was given to John Nash along with two other scholars. Nash is mainly known thanks to his portrayal in the movie by Russel Crow's 'A Beautiful Mind'.

Texts come from: https://kawiarniaszkocka.matmatic.pl
They were translated by Jakub Goryl a student of High School No 5, Bielsko-Biała
Picture of Pi number comes from: https://fakty.interia.pl

The Extraordinary Effectiveness of the Mathematical Description of the World I

The effectiveness of mathematics in sciences can be surprising, as we cannot give an answer to the question of what makes the language of mathematics fit the world so well, or rather fit the image of reality as the result of, among others, physical theories. Why the world is mathematical, why the processes that occur in it can be expressed in mathematical language? Why the constructs of human thought, the mathematical concepts, give us access to layers of information that was not included or even expected? In what way equations can turn out to be 'wiser' than their creators? Questions posed in this way define the fundamental problem of the mathematicality of the world, which is the continuation of the philosophical problem of intelligibility of being (intelligibilitatis entis). To answer these questions, one must refer to specific facts in the development of mathematics, physics, and natural philosophy and natural science. These facts are so numerous that this issue could require multiple treatises, and this is not the objective of this short paper. I would only like to delineate the fundamental issue of epistemological and ontological dimension of mathematical language in learning about the world.

From the very beginning, the Greek scientific thought took three routes: metaphorical, mathematical and empirical. It transpired that explaining the world was a struggle against the matter of language that allows for the development of new, rational (in contrast to mythological) explanations of the world. Whereas the philosophical (metaphorical) description of the world would make us attain the truth about the world and to answer the question: 'What is that and why?', the mathematical description was the answer to 'How is it?'. The science of the Modern Era realized the importance of that second question when Galileo noticed that the 'book of nature' is written in mathematical language. Since that time, we can observe an increased development in the natural sciences, owing to the mathematics utilized by them. In Galileo's realization, taking into account the impressive development of modern physics, the important element is not only the language of mathematics suited to describe the patterns in the functioning of nature, but something vastly more important – the sense hidden in this language. In this view, the world is a book containing information that science attempts to decode. Because some kind of structure is always the medium of information, and in our case, we take mathematical structures into consideration, therefore the solution to the issue of mathematicality of nature depends for the most part on the recognition of the degree to which the world and mathematics are similar.

dr hab. Krzysztof Śleziński prof. UŚ

Stephen Wolfram (born on that day, 29th August 1959) is a British-American computer scientist, physicist, and businessman. He is known for his work in computer science, mathematics, and in theoretical physics. In 2012 he was named an inaugural fellow of the American Mathematical Society.
As a businessman, he is the founder and CEO of the software company Wolfram Research where he worked as chief designer of Mathematica and the Wolfram Alpha answer engine. His recent work has been on knowledge-based programming, expanding and refining the programming language of Mathematica into what is now called the Wolfram Language.

Picture and text come from wikipedia

This newsletter was prepared by: Jakub Goryl, Bożena Gwiżdż-Urbaniec, Aleksandra Haberny, Janusz Jakubiec, Michał Knefel, Tomasz Szymczyk, Krzysztof Śleziński

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