The **STEAM-STEINETTES** Gazette

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Math

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> "WE WILL ALWAYS HAVE STEM WITH US. SOME THINGS WILL DROP OUT OF THE PUBLIC EYE AND WILL GO AWAY, BUT THERE WILL ALWAYS BE SCIENCE, ENGINEERING, AND TECHNOLOGY. AND THERE WILL ALWAYS, ALWAYS BE MATHEMATICS."
>
> - Katherine Johnson

Unraveled: The Mysteries of Atomic Geometry | **By: Sofia J.**

In a first-of-its-kind achievement, researchers from the University of Nottingham and Imperial College London have made a groundbreaking discovery regarding the properties of atomic geometries. The team created a periodic table for shapes, known as Fano varieties, and assigned quantum periods to each shape. These quantum periods function as "barcodes" or "fingerprints" that provide a description of the shape. By employing a new machine learning approach, the researchers were able to efficiently analyze these barcodes, thereby identifying shapes and their characteristics, such as dimension. You may be wondering: “Why is this discovery important?” Here is why: it is believed that this innovative use of artificial intelligence has the potential to revolutionize the field of mathematics by detecting patterns in complex domains like algebra and geometry. Co-author and Ph.D. student Sara Veneziale expressed the team’s enthusiasm, stating, "We're really excited about the fact that machine learning can be used in pure mathematics. This will accelerate new insights across the field" (Veneziale). Overall, this discovery holds immense promise in the realm of atomic geometry and is eagerly anticipated across the mathematics community.

Read on! →

SCIENTIST SPOTLIGHT

By: Jasmine P.

Marian Roque

Look up women mathematicians and you will get a plethora of results; some more heard of than others, and some still without the recognition they deserve. Now, look up women mathematicians of the Philippines and you will only get two. Due to this, Marian P. Roque is considered one of the Philippines' first Filipina mathematicians. She specializes in partial differential equations and ordinary differential operators. Her interest in math began in school when she participated in mathematics competitions and the Philippines' first ever National Quiz Bee. She earned her Bachelor of Science in Mathematics in 1986 and her Master's Degree in 1989.

While working on her Ph.D., she studied under the Sandwich Program, a program involving hands-on work with the student's intended field. This gave her the chance to do her dissertation at the German University of Essen where she would earn her degree in 1996. While in Germany, she was faced with assumptions that she was only in the country to find a husband. At the time, there were not many female mathematicians, and a study from 2021 showed that women made up only thirty-five percent of STEM students in higher German education. Filipina mathematicians were even less heard of. Doctor Roque stated, "I faced a lot of challenges being a Filipina so I needed to be assertive, which was hard at first when I was still learning their language" (Roque). Throughout her career, she endured misogyny and strived to be more than the stereotypes expected of her. "I just had to prove to myself that I can do mathematics too, like men, or even better. I had to prove not just theorems, but what Filipina mathematicians are made of. We are not just pretty faces" (University of the Philippines).

Doctor Roque has accomplished so much throughout her career, such as writing many books on partial and ordinary differential equations, teaching at the University of the Philippines Institute of Mathematics 35+ years, and being the former president of the Mathematical Society of the Philippines. Additionally, she has proved the invalidity of the sterotypical perspective that successful women cannot have children and that women are only meant to be housewives by rasing her daughter to become a successful doctor. Doctor Roque believes the key to attracting more women interested in STEM to careers in STEM is visibility. Highlighting and celebrating the achievements of women in math and science fields helps break down bias and inspires the future women in STEM. During voting season, she reminds society, especially women, to nominate someone who will strive for genuine equality and put an end to gender-based violence. She's been featured in both the #BreakTheBias movement and the #womeninSTEM movement. What an inspiration.

Math Puzzles

Middle School Math

1. Convert 0.235 to a percentage

2. 0.7438 × 104 = ______

3. Mike has 50 pieces of candy. He wants to give 18% of them to each of his 3 friends. How many pieces of candy will Mike have left?

High School Math

1. $x^2 - 2x + 5 = 0$. Solve for x.

2. Find the derivative of $y^x = x^y$.

3. Determine the circulation of the vector field $\vec{F}(x, y, z) = \langle 3x + y, 2x - z, y + 2x \rangle$ about the surface defined by $x^2 + y^2 + z^2 = 9$, $z \geq 0$.

Click Here for the Answer Sheet!

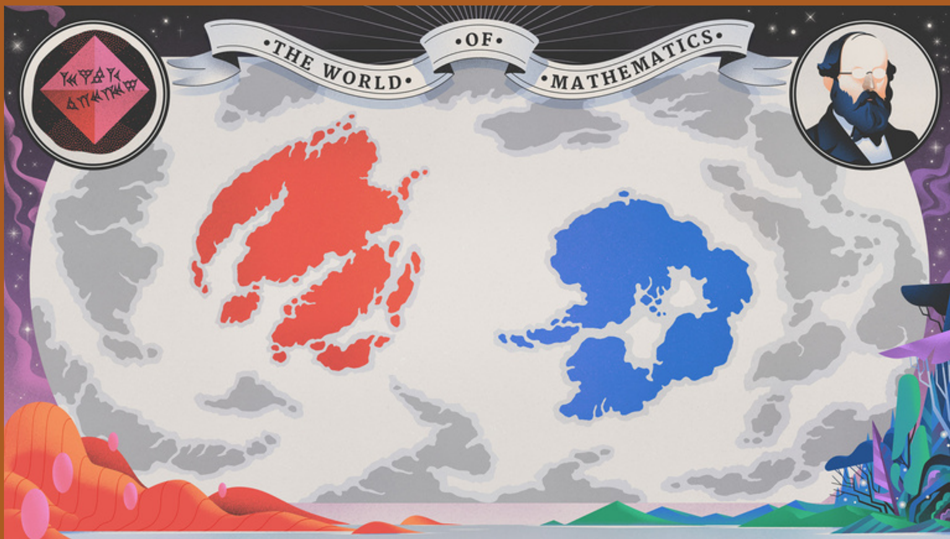
World Math News

By: Hitej

A new advancement was made with Ramsey numbers, after 80 years of fruitless attempts.

David Smith discovers an aperiodic monotile where the tile covers a plane, but its pattern never repeats.

A new record was broken for the number of integers you can put in a set without having the same gap between any three of them. (Ex: 2, 5, & 8)



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

THE LANGLANDS PROGRAM

By: Ace

Most people think mathematics is static, but that could not be further from the truth! Math is an ever-evolving field driven by new discoveries and the connecting of previously disconnected branches. And while the basic principles do not change (for instance, 1 plus 1 is still 2, regardless of when or where you live), even the most fundamental things we take for granted can be seen in an entirely different light that reveals previously unknown or hidden properties. This is one of the key ideas behind what is commonly termed the biggest project in modern mathematics—the Langlands program. This project is meant to build a “bridge” of sorts between previously isolated branches of math in order to solve problems that otherwise might be too difficult to tackle (and these problems may cover more than just pure mathematical objects). While it spans many different fields nowadays, the original version proposed by Robert Langlands first hinted at a connection between the fields of harmonic analysis and number theory. Here’s a brief explanation of what those are, how they are connected, and why that matters—just to give you a taste of how revolutionary this program will be in modern mathematics.

Let’s start with number theory, the one of the two you might have heard of before. Number theory is defined by Britannica (the website) as the “branch of mathematics concerned with properties of the positive integers” (par. 1). It uses arithmetic in creative ways to explore relationships between numbers. Since it deals with arithmetic, it is more common to come across it even as a non-mathematician. Harmonic analysis, however, is more obscure; according to the same site, it is a “mathematical procedure for describing and analyzing phenomena of a periodically recurrent nature” (par. 1), which basically means it’s the branch of math designed to handle things that repeat themselves (like sine waves and far more complex periodic functions). At first glance, these two fields don’t seem to be connected at all—after all, how do you go from something as simple as arithmetic to analyzing the complex functions that harmonic analysis deals with? It took some time and a great deal of thinking to figure out. And while the full solution is as complex as it is fascinating (and I encourage you to look up elliptic curves, infinite power series, modular form, and Fermat’s Last Theorem), the short version is by studying special curves with the tools of number theory, converting those curves to intermediate forms, and using those intermediate forms to finish converting the curves to equivalent forms that could be studied and analyzed with harmonic analysis. Thanks to mathematicians like Ramanujan, Taniyama, Shimura, Weil, and Wiles (among many others), it is now possible to connect number theory and harmonic analysis through this conversion process, which allows us to study and discover fascinating properties of objects we previously only saw in a surprisingly limited light.

At this point, you might be thinking that the Langlands program might just be a pastime for pure mathematicians; but it actually has implications that can extend from mathematics to the realm of physics. The large-scale version of the program might allow us to form a unified picture of the various divided mathematical branches and connect it with other branches of knowledge, which would give us far more powerful tools for exploring the world and the universe beyond. While this program may not be as easy and entertaining to follow as an episode of Stranger Things on Netflix, I think we are yet to see lots of strange, new wonderful things in mathematics coming up as a result of it. Don’t you agree?

The Imitation Game

MOVIE REVIEW | BY: ACE

It's World War II and the Nazis are unbeatable. The Allies can intercept their messages, but all messages are encoded by a special machine, Enigma, that is impossible to decode. ... Or is it? Alan Turing, Hugh Alexander, and other mathematicians and cryptographers work day and night to decode the machine, only to have all their efforts prove futile when the clock strikes midnight and the Nazis reset Enigma for the following day. Human brute force alone won't solve the problem, but, luckily for the Allies, Alan Turing already has something in mind—a machine that will be able to decrypt Enigma and allow them to uncover Nazi plans before they happen. Based on the true story of Alan Turing, The Imitation Game is a movie of brilliance, tragedy, and shocking turns that leave you on the edge of your seat. I deeply enjoyed the movie and I would recommend it to anyone who has a passion or interest in mathematics, computer science, or puzzles.

Movie

Review Rating: 5/5

Fantastic Facts!

By: Bailey

Benford's Law: Random patterns aren't truly random, and in a set of values there tends to be a greater amount of numbers with small digits at the beginning.

Number 3 is said to be the most used number in mathematics. In ancient Greek history, the number 3 was considered "the perfect number."

Mesopotamia is most likely the first civilization to ever use math, it allowed them to count crops and build structures with geometry.

Meet the Team

A

STEAM Club

+

The Einsteinettes

collab

Durga I.

Ace M.

Sofia J.

Hitej R.

Bailey WR.

Stephanie A.

Jan P.

Diana S.

Vasilisa B.

Jasmine P.

Special thanks to our awesome advisors, Ms. Cristen Jones and Mr. Chad Hamblin!

Not mentioned: Quote provided by Stephanie

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