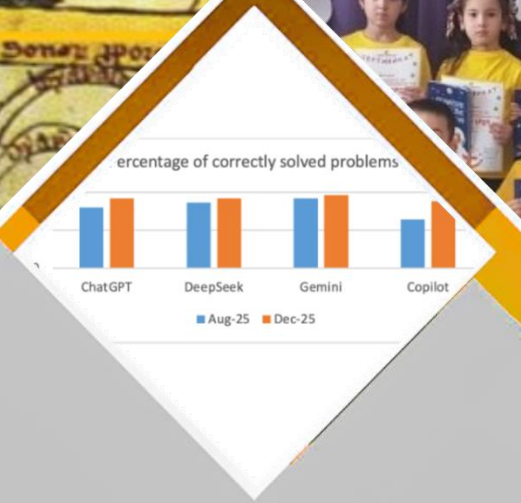
AKSF NEWSLETTER

Issue 15
January 2026



Hello and welcome to our 15th edition of Kangourou sans Frontieres Newsletter.

Joanna Matthiesen
joanna@mathkangaroo.org

Dear Friends of Kangaroo,

Happy New Year! As we count down to Kangaroo 2026 Day on March 19, we are excited to share what's ahead—and to celebrate a remarkable milestone.

This year marks **35 years of Kangaroo Game**. What began on May 15, 1991, in France has grown into a global movement, bringing together millions of students worldwide on the same day with one shared mission: fostering mathematical thinking, curiosity, and joy. Thanks to the inspiring leadership of André Deledicq, Gregor Dolinar, and now Meike Akveld, Kangaroo continues to thrive—while staying true to its core purpose.

We are excited to support new ideas initiated by our members. Some of these ideas include a Team Competition and a Kangaroo program for adults, initiatives started by AKSF members for the growth of Kangaroo awareness and ongoing support in all 100+ kangaroo countries for kids and now adults as well.

We continue to expand our educational outreach. In 2024, the U.S. and Canadian teams hosted our first open international teacher workshop, and in Fall 2025, we partnered with the Norway Kangaroo team to explore advanced problem-solving strategies and the reusability of Kangaroo questions. Next month, we have another exciting opportunity for educators: a special seminar for teachers on February 7, hosted by the U.S. team and led by Michael Lambrou (Greece Kangaroo team). Teachers from all countries are warmly invited to join.

I wanted to wish you and children around the world a joyful and inspiring competition on Thursday, March 19, as we continue celebrating curiosity, learning, and our global Kangaroo community.

Warm regards,
Joanna Matthiesen
Editor-in-Chief

News from the President

Meike Akveld
meike.akveld@math.ethz.ch

Dear Kangaroo friends,

It's a pleasure to share a few words for our winter Newsletter. I hope you all returned home safely from our meeting in Istanbul and are now fully engaged in preparing for the 2026 Kangaroo competition. The board members also travelled back without incident, and several of us are now deeply involved in the Charitable Grant initiative approved by the General Assembly.

We are entering an important new chapter for our association, and naturally, some aspects are still taking shape. At the moment, we are working on two main fronts: strengthening and professionalizing our IT infrastructure, and determining how to receive the generous donation—along with navigating the financial and legal requirements that come with it. We will share more details as soon as we have clearer information.

For now, I would like to express my sincere gratitude to Robert Geretschläger and Cristina Diaz, who are devoting an exceptional amount of time and energy to this project. Thank you both!

What else has been happening since our Fall meeting in Istanbul?

To start, the finalisation process has been completed in November. My sincere thanks to everyone involved—your dedication and behind-the-scenes work make a tremendous difference, and we are all indebted to you.

THANK YOU!

Below are a few highlights of what has been launched since the Fall meeting, along with ongoing efforts that continue to develop:

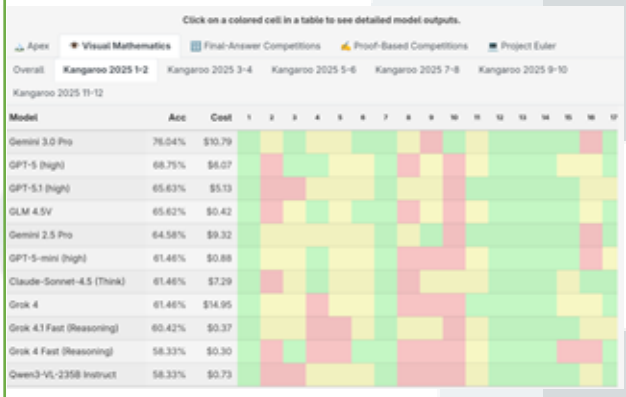
- You may have noticed that the solutions PDF now includes the countries that proposed each problem. We hope this added detail helps you highlight the international spirit of our competition within your own communities.
- The Global Maths Kangaroo competition, which had its kick-off meeting in Istanbul, will see its first pilot in 2026. More about that from other people. Thanks to everyone involved.

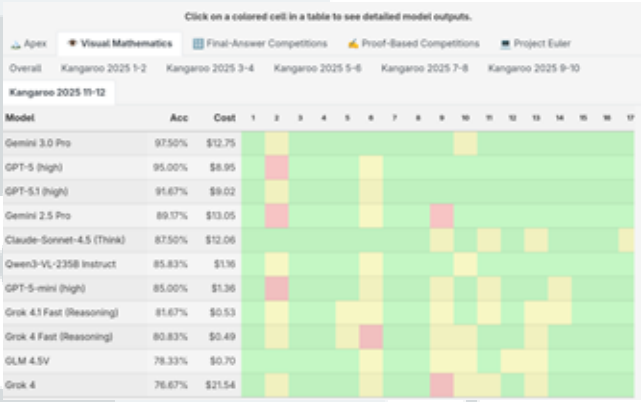
- As mentioned earlier, we have established the fund—AKSF4D—to support members who may need financial assistance to participate in our meetings. Please donate!
- We are also continuing our efforts to strengthen our presence on social media. If you have news to share, please email it to aksfnews@gmail.com. And of course, we invite you to follow us on Facebook and Instagram.
- Besides from that, all regular operations continue: finances, support for applicants and provisional members, and everything else that keeps our association running smoothly.

everywhere. Colleagues at my institution, the ETH Zurich, studied how AI performs in maths competitions. You may be interested to check the following website:

https://matharena.ai/

Under "Visual Mathematics" you find the performance of various AI models on the Maths Kangaroo questions from last year. Interestingly the younger the age group, the worse the models perform (see tables below, on the left Pre-Ecolier, on the right Student). It seems this boils down to the pictures. Is it only a matter of time, until these models master this too, or is there more to it? Time will tell.





Finally, I want to express my deep appreciation to all contributors to this Newsletter. A special thank-you goes to Joanna, Özgür, and the entire editorial team for their outstanding work in ensuring that everything comes together so well. Your commitment truly shines.

As you will see, many of the articles in this Newsletter are about AI, I guess it is the buzz word

If you have ideas for future articles, please reach out to Joanna. Whether you already have a concept or would like guidance in shaping one, she will be happy to support you. Our Newsletter remains one of the best ways for us to learn about each other's projects and experiences—opening doors to new insights, conversations, and collaborations.

Take care and stay healthy!
Yours,
Meike
AKSF President

AKSF Ethics Committee

Ria Van Huffel
riavanhuffel@hotmail.com

Rafael Sánchez
lamonedar@gmail.com

At the AKSF annual meeting, in Istanbul, the AKSF Board consulted us about creating an Ethics Committee. The idea arose from the International Mathematical Olympiad (IMO)'s Ethics Committee and our experience in this area.

Although the IMO and the Kangaroo contest are very different activities, the sustained growth of the AKSF and the large number of students participating each year necessitate the establishment of an ethics committee. This committee can collaborate with the AKSF Board on issues related to the organization of the Kangaroo contest (such as compliance with the bylaws) or on problems that may arise during the annual AKSF meeting (e.g. bullying, discrimination, harassment etc.).

Modus operandi

The Ethics Committee of the AKSF (AKSF E) can be contacted by the AKSF Board (AKSF B) or by individuals, i.e. any (former) participants or national organizers, to formulate advice on AKSF matters (contest, organization, compliance with the bylaws etc.).

The AKSF E reports to AKSF B. The AKSF E addresses the AKSF general assembly each year and reports the number of cases, the nature of the cases in general terms and any action taken.

Tasks

The Ethics Committee of the AKSF

- gives advice on moral questions that may arise.
- identifies areas of ethical risks and develops strategies to address these risks.
- gives advice for making sure AKSF is living up to its ethical commitments, as must be stated in the Bylaws.
- investigates allegations of inappropriate conduct (e.g. bullying, discrimination, harassment etc.). [note that the investigation of AKSF E stops whenever legal investigation is involved]
- makes suggestions to AKSF B about the best course of action.
- makes recommendations to AKSF B for improvement where necessary.

Composition and election of AKSF E

The AKSF E will be composed of three persons who have a strong connection with the AKSF and who may or may not be country representatives.

The members are elected by vote during the General Assembly and have a term of office of four years, after which they may be re-elected. After each election, the elected members of the AKSF E appoint a president and a secretary among themselves.

Upon the installation of the AKSF E, two members shall be elected for a period of four years and one member shall be elected for the first term for a period of six years. After the end of their elected term, elections shall be organized in which the newly elected members shall be appointed for a term of four years. By incorporating alternating terms, continuity within the AKSF E is ensured over the years.

If, for any reason, an elected member is no longer able to participate in AKSF E, interim elections are held to replace that member. The replacement serves for the remainder of the term of the member being replaced.

Communication

The AKSF E will respond to every question.

Anonymous messages will receive an acknowledgement of the receipt of the concern but no more.

Summary

Further details regarding the formation of the committee will be shared during the annual meeting in Fall 2026.

Ria Van Huffel and Rafael Sánchez

AI in Math Problem Solving

Yahya Tabesh
yahya.tabesh@gmail.com

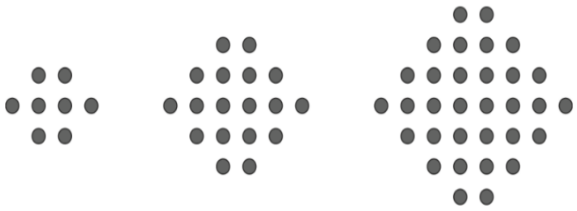
The widespread adoption of AI models is profoundly transforming the educational ecosystem. It brings an opportunity to engage the learner as an active participant to design, create, and experiment through project-based work that aligns with their interests, fostering collaboration, creativity, and curiosity, and developing their own knowledge.

The **constructionist** approach is vital for developing **higher-order cognition**—the mental processes like reasoning, perception, and metacognition that underpin creative problem-solving. Within this paradigm, AI's optimal role is not as a more efficient instructor, but as a **cognitive partner**. It serves as a tool for discovery, enabling students to explore complex ideas and build knowledge in a dynamic environment, ensuring the focus remains on deep cognitive learning.

To demonstrate how AI can function as a collaborative partner and enhance human creativity, we will show a Large Language Model's problem-solving process on one of the math Kangaroo problems. This will illustrate its potential as a powerful tool for learning and innovation.

Problem-Solving

To demonstrate the problem-solving capabilities of a Large Language Model (LLM), we tasked the model with applying Polya's four-step method. This approach allows us to better analyze the model's underlying cognitive processing. As a case study, we selected Problem 6 from the Student level of the 2025 Kangaroo problems. We initiated the analysis using the following **prompt**:



Apply Polya's four-step method to solve this problem: The shapes shown are the first three shapes of a sequence. How many dots make up the fifth shape in the sequence?

Model response:
https://gemini.google.com/share/b0c5a441d084

Based on your interest in formal problem-solving frameworks, here is the solution structured using **Polya's Four-Step Method**.

Step 1: Understand the Problem

We are presented with a visual sequence of three shapes constructed from dots.

- **Goal:** Determine the total number of dots that would make up the **5th shape** in this sequence.
- **Given:**
  - Shape 1 (small)
  - Shape 2 (medium)
  - Shape 3 (large)
- **Observation:** The shapes are growing symmetrically. We need to translate this visual growth into a numerical pattern.

Step 2: Devise a Plan

To solve this, we will:

1. **Count** the exact number of dots in each of the three provided shapes to create a number sequence.
2. **Analyze** the structure of the count. We can look for a mathematical relationship between the "Shape Number" (n) and the "Dot Count" (D_n). We can do this by looking at the columns of dots or by finding the difference between terms.
3. **Generalize** the pattern into a formula.
4. **Calculate** the value for the 5th shape ($n=5$).

Step 3: Carry Out the Plan

1. Counting the dots:

Let's count the dots by looking at the vertical columns from left to right.

- Shape 1 ($n=1$):
  Columns: $1, 3, 3, 1$
  Total: $1 + 3 + 3 + 1 = \mathbf{8}$
- Shape 2 ($n=2$):
  Columns: $1, 3, 5, 5, 3, 1$
  Total: $1 + 3 + 5 + 5 + 3 + 1 = \mathbf{18}$
- Shape 3 ($n=3$):
  Columns: $1, 3, 5, 7, 7, 5, 3, 1$

Total: $1 + 3 + 5 + 7 + 7 + 5 + 3 + 1 = \mathbf{32}$

2. Analyze the Pattern:

Let's look at the sequence: 8, 18, 32.

- Method A: Algebraic Formula
  Notice that the sums can be grouped into two identical halves:
  - Shape 1: $2 \times (1 + 3) = 2 \times 4 = 8$
  - Shape 2: $2 \times (1 + 3 + 5) = 2 \times 9 = 18$
  - Shape 3: $2 \times (1 + 3 + 5 + 7) = 2 \times 16 = 32$
- The sum inside the parentheses is the sum of odd numbers. The sum of the first k odd numbers is always equal to k^2.
  - For Shape 1, we used the first **2** odd numbers ($2^2 = 4$).
  - For Shape 2, we used the first **3** odd numbers ($3^2 = 9$).
  - For Shape 3, we used the first **4** odd numbers ($4^2 = 16$).
- So, for Shape n, we use the first $(n+1)$ odd numbers.
  Formula: $D_n = 2 \times (n+1)^2$
- Method B: Differences
  Let's find the gap between the numbers:
  - $18 - 8 = 10$
  - $32 - 18 = 14$
    The difference is increasing by 4 each time ($10, 14, 18, 22 \dots$).

3. Calculate for Shape 5 ($n=5$):

Using our formula $D_n = 2 \times (n+1)^2$:

$$D_5 = 2 \times (5+1)^2$$

$$D_5 = 2 \times (6)^2$$

$$D_5 = 2 \times 36$$

$$D_5 = \mathbf{72}$$

$$D_5 = \mathbf{72}$$

Step 4: Look Back

Let's verify our result using **Method B (Differences)** to see if it matches.

- Shape 1: **8**
- Shape 2: **18** (Difference: +10)

- Shape 3: **32** (Difference: +14)
- Shape 4: $32 + 18 = \mathbf{50}$ (Difference increases by 4, so $14+4=18$)
- Shape 5: $50 + 22 = \mathbf{72}$ (Difference increases by 4, so $18+4=22$)

Both the algebraic formula and the differences method yield the same result.

Answer: The fifth shape in the sequence is made up of **72** dots.

Analysis:

The model correctly interpreted the problem statement and the visual data. Furthermore, it successfully adhered to the instruction to apply Pólya's four-step method. A detailed analysis of the model's performance across each step follows:

- **Step 1: Understanding the Problem.** The model demonstrated strong comprehension by accurately analyzing inputs from both the text and the attached image. It correctly identified the objective as a pattern recognition task involving a growing sequence.

- **Step 2: Devising a Plan.** The model established a coherent and logical strategy. It prioritized a numerical analysis of the input shapes to detect the underlying progression, outlining a distinct path toward the solution.

- **Step 3: Carrying Out the Plan.** By synthesizing the dot counts with the geometric properties of the shapes, the model successfully decoded the pattern. It utilized two distinct methods to accurately calculate the number of dots required for the fifth iteration.

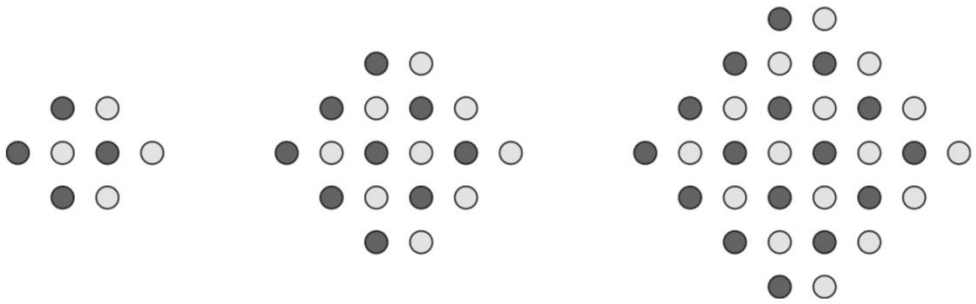
- **Step 4: Looking Back.** The model exhibited sophisticated reasoning by deriving the general formula based on the geometric structure. It provided a clear verification of the final answer, ensuring the result was robust.

Remark

The model followed Pólya's four-step method with precision, demonstrating both numerical and geometrical approaches that enhance cognitive learning. While the current output has significant educational value, the model's utility could be further augmented through an interactive, step-by-step approach using well-defined prompts or built-in "Guided Learning" features.

Cognitive Learning

In the solution of the problem by the author, the following shapes have been shown:



While the author's solution relies on clear geometric shapes to build intuition, the current model relies exclusively on wording. This purely textual approach misses the vital cognitive scaffolding that imagery provides. To truly support learners, LLMs must evolve to embrace visualization.

We need problem-solving environments that empower users to create and refine their work, transforming their relationship with technology from passive consumption to active control. For young learners, this means shifting toward interactive, visual platforms that teach the *strategy* of problem-solving —breaking down challenges and iterating— while preserving the joy of discovery.

We envision the next frontier of LLMs as interactive, narrative playgrounds where problems are personified and visualized. Here, learners actively construct knowledge, turning structured thinking into a natural, intuitive power. By solving problems through creative exploration, learners experience the satisfaction of a genuine breakthrough. This is the future of AI: a model of co-intelligence that amplifies human creativity rather than automating it away.

References

- Polya, G. (1945). *How to Solve It*. Princeton University Press.
- Tao, T. (2006). *Solving Mathematical Problems*. Oxford University Press.
- Papert, S. (1980). *Mindstorm*. Basic Books Inc.
- Resnick, M. (2017). *Lifelong Kindergarten*, MIT Press.
- Google. (2025). *Gemini* (December 2025) [Large Language Model]. http//gemini.google.com/.

Performance Analysis of AI on Math Kangaroo Contest Problems

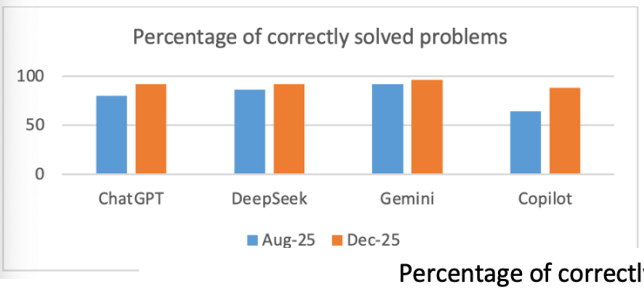
Rossitza S. Marinova
rossitza.marinova@concordia.ab.ca

This study evaluates four widely used generative AI models - ChatGPT, DeepSeek, Gemini, and Copilot - on competitive mathematical problems from the Association Kangourou sans Frontières. Drawing on problems from the Canadian Math Kangaroo Contest website, each model is assessed for accuracy, clarity of explanation, response speed, and ability to interpret image-based input. The results show distinct problem solving approaches: some models respond quickly and clearly, while others rely more on analytical or visual methods. Overall, the findings highlight the strengths and limitations of current AI tools in academic contexts and their potential to enhance mathematics education and learning.

Studying AI tools on competition problems helps assess their accuracy, reasoning, educational impact, and limits. As reliance grows among students and educators, the quality of reasoning, clarity, and handling of visual data matter as much as correct answers. While AI tools can provide solutions, educators focus on building problem-solving and critical-thinking skills to prepare students for applying mathematical reasoning in diverse contexts.

The dataset contained 50 problems from Grade 11-12 (Student) level from 2002-2023. Initially, problems were selected, and reviewed for clarity and detail. Problems varied in textual and visual formats and tested models' comprehension and reasoning skills. Questions were submitted separately to all four AI models. Consistency was ensured by using the same phrasing and image where applicable. Models allowing image input like Gemini and DeepSeek uploaded the image directly. For those unable to process images - like Copilot - a textual description or transcription was provided to simulate a visual scenario. Total correct responses per model were recorded. Beyond numerical accuracy, qualitative insights were derived. This analysis provided clearer insight into each model's strengths and weaknesses. For instance, one model excels in number theory but struggles with visual geometry.

The percentage of correctly solved problems as of early August 2025 and as of December 14, 2025 are shown below. The AI tools clearly evolve and improve with time.



Percentage of correctly solved problems

	ChatGPT	DeepSeek	Gemini	Copilot
August 2025	80 (GPT-4-turbo)	86 (V3)	92 (2.5 Flash)	64 (Standard)
December 2025	92 (GPT-5.2)	92 (V3)	96 (2.5 Flash)	88 (GPT-5)

Results suggest that while all models demonstrate ability in solving mathematical problems, their actual performance differs substantially. Specifically, Gemini and DeepSeek scored better in questions involving pattern recognition and visual reasoning because they allow multimodal input and more advanced reasoning algorithms. ChatGPT did very well in algebraic and word-based problems demonstrating its ability to understand complicated instructions and keep logical flow. Although GitHub Copilot was not designed for mathematical problem-solving, it successfully solved a fair number of problems correctly, which shows its surprising flexibility outside of code-related tasks.

However, the evaluation also pointed to common problems among the models, including sometimes misinterpreting question prompts, inability to process visual input in some cases and inconsistent logical steps during explanations. These shortcomings show that generative AI has progressed but is not yet reliable for high-stakes academic use in mathematics without human oversight. Gemini demonstrated best overall accuracy and performed well for text and image inputs. It responded quickly and was generally reliable, though it occasionally repeated answers when confused by image data. DeepSeek often provided detailed and explained solutions. Its slower processing and occasional over-analysis however produced unexpected errors starting with a seemingly correct approach. It had occasional server delays too. ChatGPT delivered consistent, balanced performance. While slightly behind in total correct answers, it provided clear, structured explanations with no technical issues, making it a reliable tool overall.

Copilot is usually very good at code-related tasks, but had the worst performance with problems with mathematical reasoning and logical problem solving. The model generally gave short, sometimes vague responses and was significantly less successful than the other models.

The following problem highlights the performance of AI models that failed to solve it correctly during testing: *The vertices of a 20-gon are numbered from 1 to 20 in such a way that the numbers of adjacent vertices differ by either 1 or 2. The sides of the 20-gon whose ends differ by only 1 are colored red. How many red sides are there?* The correct answer is 2. All failed to solve it correctly (as of August 2025), while Copilot and DeepSeek were successful in November 2025. Google Gemini incorrectly assumed that a link such as (19,1) was allowed, leading it to conclude that there were 10 red sides. Google Search, however, surfaced a correct solution from the Kangaroo Kuwait website. When we then asked ChatGPT how the numbers could actually be arranged so that adjacent vertices differ by only 1 or 2, it was able to construct a valid arrangement and correctly solve the problem.

Overall these observations suggest that AI models can solve standard problems well but suffer when tasks involve detailed case validation, increased linguistic sensitivity and explicit exception handling.

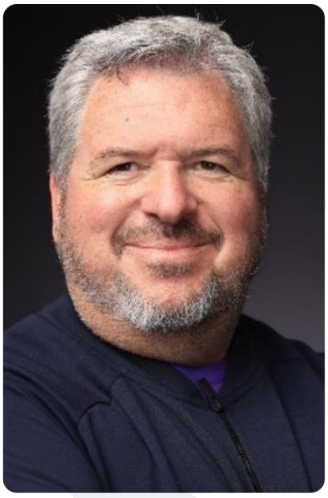
Rossitza S. Marinova,

Deepanshu Khanna

Concordia University of Edmonton,

Alberta, Canada

Article about Kangaroo Anti-Cheating Strategy Meetings



Steve Sherman
steve@livingmaths.com

At the recent gathering of Kangaroo delegates in Turkiye in Oct 2025, one of the issues that concerned me was the number of colleagues that had lamented about cheating in their competitions. This is something that impacts the integrity and reputation of the competition and yet it also offers us an opportunity to solve a problem! I volunteered to gather members that felt strongly about finding ways to reduce cheating in their events. I then proposed that we meet and develop a document. 36 people joined the whatsapp group! I then facilitated two separate Zoom sessions to offer various countries in different time zones, to participate.

Two successful online meetings were convened on the 15th of Dec, to examine academic dishonesty risks in Kangaroo mathematics competitions and to develop practical mitigation strategies for both paper-based and digital events. Participants included organisers and stakeholders from Europe, Asia, Africa, and South America, bringing a broad range of operational perspectives and real-world experiences.

The first meeting focused primarily on paper-based competitions. Key cheating methods identified included early access to papers due to staggered release dates, sharing or selling of solutions, premature access to memoranda, and unethical coaching by teachers. Cross-border leakage of papers was highlighted, along with the photographing and circulation of scripts. Participants noted that competitive pressure, profit motives, and weak accountability structures in some centres increase the risk of misconduct.

Proposed mitigation strategies included tighter control over release dates, delayed memo publication, reducing the competition window to a single day, and preventing students from retaining or photographing scripts. Additional safeguards discussed were the introduction of control questions.Formal integrity declarations for students and teachers, stricter invigilation guidelines, and clearer participation rules at country level were strongly recommended.

The second meeting concentrated on digital events. Identified risks included unsupervised participation, real-time collaboration, screenshot sharing, and solution visibility immediately after completion. Mitigation measures proposed included stronger digital proctoring, watermarking, screen-locking, and multi-camera supervision. The use of data analytics and AI to detect abnormal completion times, identical response patterns, and year-on-year performance anomalies was discussed in detail. Statistical tools such as pattern analysis and comparative error indices were highlighted as promising detection mechanisms.

Additional points included legal considerations around copyright enforcement, social media takedowns, and the need for formal cease-and-desist processes. Overall, both meetings emphasised that fairness, transparency, and robust systems are essential to protecting the integrity and reputation of the competition.

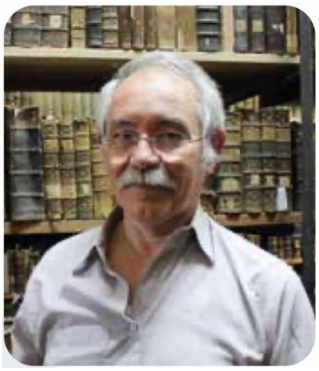
Please feel free to add ideas or comments to the document. I would love to hear about the experiences of cheating in your competition, what you did about it and what solutions you can propose to help us reduce the cheating in future events. Find the document in the link below. It contains recordings of the two meetings, summaries of both meetings and the collaborative working document.

https://docs.google.com/document/d/1lDQ9FpPiBeNI_faq8-dpzofdFsKaTdmMPsTeN2ywYeo/edit?usp=sharing

Steve Sherman

Scripta Manent

The purpose of this column is to discuss, periodically, proverbial phrases from philosophy, literature or history that are relevant to Mathematics. In each case, we explore the origin, meaning, and use of maxims which mathematicians and intellectuals often like to refer to.



Michael Lambrou
lambrou@uoc.gr

Σώζειν τα φαινόμενα or Salvare Apparentias

The Latin expression *salvare apparentias* ("saving the appearances") is a later rendering of the Greek phrase *sozein ta phainomena* meaning "to save the phenomena". The expression is traditionally attributed to the outstanding ancient Greek Philosopher Plato (427–347 BC) and is commonly understood as articulating a methodological demand central to ancient Astronomy. Namely, that celestial phenomena, such as the motions of Planets, should be formulated in mathematical terms.

The earliest extant testimony for this attribution is not found in Plato's surviving works, but rather in the 6th-century AD commentary of Simplicius on Aristotle's *Peri Ouranou* (*De Caelo*, "On the Heavens"). Simplicius reports that this doctrine was transmitted to him by Alexander of Aphrodisias, who in turn had received it from his teacher Sosigenes; Sosigenes, finally, drew upon the now-lost *History of Astronomy* by Eudemus of Rhodes, a pupil of the celebrated Aristotle (384-322 BC).

According to Simplicius, Plato maintained that the motions of the heavenly bodies must be circular, uniform, and ordered—that is, perpetually proceeding in the same direction. On this basis, Plato posed a challenge to mathematicians to determine combinations of such motions capable of accounting for the observed phenomena associated with the "wandering stars," or planets. The objective was not merely a descriptive account of the phenomena, but to identify underlying motions whose mathematical consequences would correspond to observation.

Similar formulations recur throughout Simplicius' commentary. In several passages, he remarks that both earlier and later astronomers "save the phenomena" by means of uniform circular motions. Comparable statements are also found in Theon of Smyrna's *On Mathematical Knowledge Useful for the Reading of Plato* (2nd century AD) and in Geminus' *Epitome of Posidonius' Meteorology* (1st century BC), attesting to the enduring significance of this principle in ancient and late antique Astronomy.

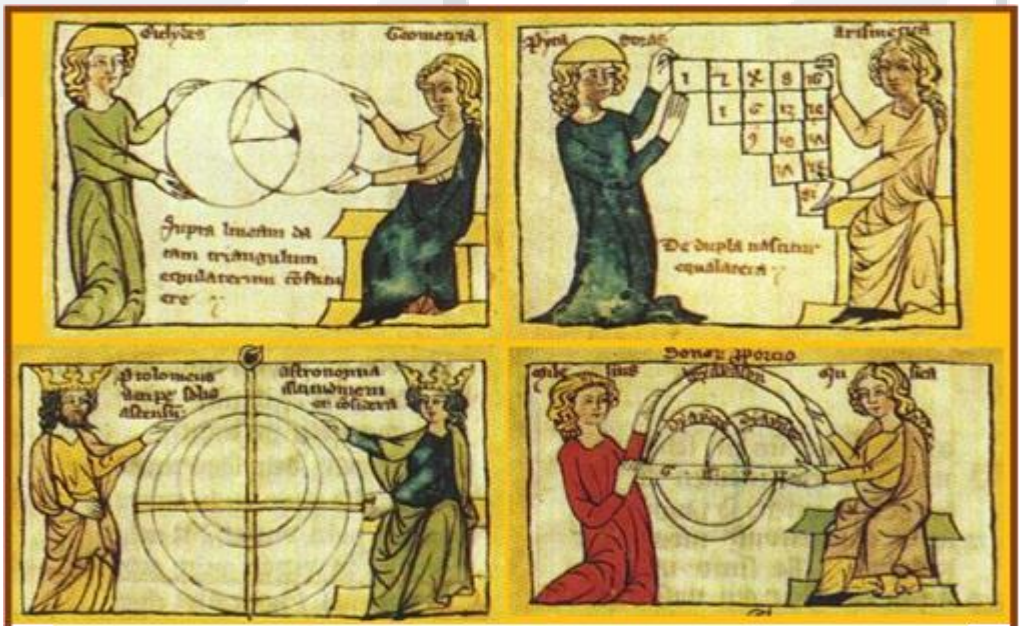
To appreciate the historical importance of this idea, it is helpful to trace its origins. As early as the 5th and 6th centuries BC, Greek thinkers began to reinterpret celestial phenomena as governed by natural rather than mythological or supernatural causes. This intellectual shift from the misconceptions of the past marked a decisive step toward the

emergence of scientific Astronomy. General principles were advanced to systematize observational data, and it became increasingly accepted that celestial phenomena were susceptible to rational explanation.

The principal limitation of these early approaches lay in their inability to provide precise mathematical descriptions of the irregularities of planetary motion. In particular, planets such as Mars, Jupiter, and Saturn were observed to slow, come to rest (stations), and even reverse their direction against the background of the fixed stars—a phenomenon known as retrograde motion. These observations stood in tension with prevailing assumptions about cosmic regularity and order. The central problem of ancient Astronomy thus emerged: how could planetary motions be described in a way that permitted reliable prediction (for example, of eclipses) while preserving fundamental assumptions concerning cosmic harmony?

Significantly, the Greek word *kosmos*, attributed to Pythagoras (580-496 BC), denotes "order" or "adornment," standing in deliberate opposition to *chaos*; the aesthetic connotations of cosmic order were certainly deeply embedded in Greek thought.

A decisive turning point occurred in the 4th century BC with Plato. In Book VII of the *Republic*, Astronomy is explicitly grouped with Arithmetic, Geometry, and Harmonics as a mathematical discipline essential to philosophical education—a grouping later formalized in the medieval notion of the Quadrivium. Plato thereby specified the kind of explanation deemed scientifically legitimate: celestial motions were to be analysed as combinations of uniform, circular, and ordered motions, accessible to mathematical reasoning. In this way, Astronomy was transformed from a primarily observational pursuit into a significant theoretical science.



The Medieval Quadrivium
Geometry, Arithmetic, Astronomy, Harmonics

The privileged status of circular motion harmonized with broader Greek mathematical ideals, exemplified by Euclidean Geometry. For example, geometric constructions were restricted to the use of the simplest lines, namely straight lines and circles, produced by ruler and compass. This restraint reflects a deeper aesthetic conviction that simplicity is a feature of elegance — a conviction shared by Greek art as well as Greek science.

Plato's influence proved decisive for subsequent astronomical inquiry, particularly during the Hellenistic period, which witnessed figures such as Euclid, Aristarchus, Archimedes, Apollonius, and Hipparchus. Within the Platonic framework, astronomers formulated hypotheses designed to yield results consistent with observation. As Proclus (412–485 AD) observes, Astronomy does not proceed deductively from hypotheses in the same way as other sciences; rather, it begins with observed results and seeks the hypotheses required to account for them. Astronomical theory, like Geometry and Harmonics, thus presupposes the formulation of appropriate axioms as a basis for its study.

Attempts to solve the Platonic problem displayed remarkable ingenuity. Eudoxus and Callippus proposed systems of homocentric spheres; Heraclides advanced alternative rotational models; Aristarchus introduced the heliocentric hypothesis; and Apollonius and Hipparchus developed the theories of eccentrics and epicycles. From this point onward, "saving the phenomena" became a defining principle of Astronomy: the task of integrating apparent irregularities into a theoretical framework that preserved the fundamental order of the Universe.

These developments culminated in the emergence of mathematical Astronomy, whose most influential synthesis is Ptolemy's *Almagest*. The system of eccentrics and epicycles dominated astronomical theory for over a millennium, until it was superseded by Johannes Kepler's formulation of elliptical orbits (1571–1630). Even then, it remained widely accepted that the sublunar world was governed by different physical laws in comparison to the celestial (above the Moon) realms. This distinction was ultimately overturned in the 17th century by Galileo Galilei (1564–1642) and Isaac Newton (1643–1727), who formulated universal mathematical laws applicable both below and above the Moon.

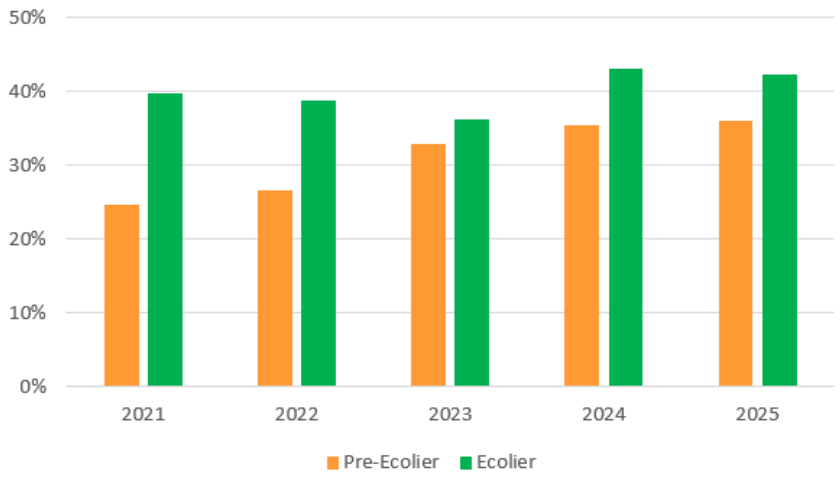
Today, the proverbial phrase "saving the appearances," or "saving the phenomena," is used more broadly to denote careful attention to observable facts when formulating or evaluating theories. It may refer to ensuring that all relevant observations are accounted for, or to confirming that an established theoretical framework remains compatible with empirical observations. In this extended sense, the ancient methodological principle is used well beyond its original astronomical context.

Michael Lambrou

A Math Game: Little Kangaroo: Kanguryonok

Ekaterina Alekseeva
org@ipokengu.ru

In 2023 after reviewing the results of the Kangaroo competition we noticed an interesting trend: in our country, the largest share of participants now comes from the early primary grades and the proportion of first-grade students is steadily growing.



As the chart shows while the percentage of participants in the Ecolier group (Grades 3-4) has remained nearly unchanged the share of Pre-Ecolier participants (Grades 1-2) has been increasing every year.

Curious about this tendency we spoke with teachers who run the Kangaroo competition in lower primary school. They told us that children happily take part in activities requiring ingenuity rather than formal school knowledge. Today's young learners are curious, active and eager to join various contests, always trying to do a little better than their classmates. For them it is both a challenge and an exciting game.

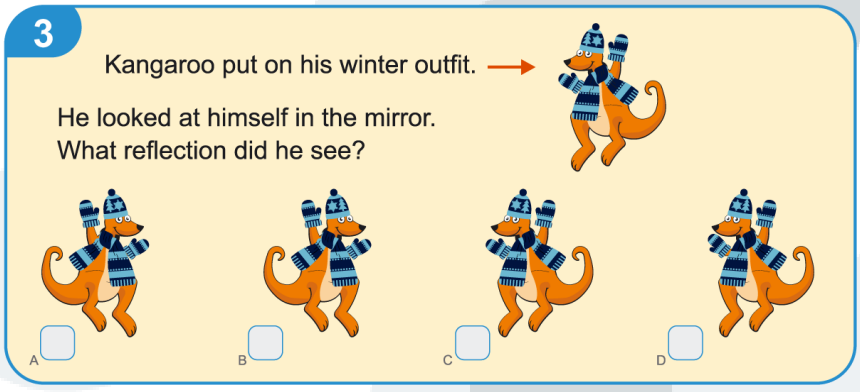
Kangaroo is a bright and joyful experience - and they also receive prizes. Every participant gets a small souvenir, and winners also receive additional Kangaroo-branded gifts that cannot be bought or obtained any other way.

We were pleasantly surprised by how much interest the competition generates among younger students and their families. Of course this interest does not appear suddenly once children start school. That means preschoolers may also enjoy taking part in something similar. It was therefore natural for us to create a mathematical game for preschoolers and first-graders named Kanguryonok (Joey).

The game is based on the Kangaroo concept: engaging puzzles of varying difficulty adapted for children aged 5–7. We assembled a dedicated team of mathematics teachers specializing in early childhood education for creating the problems. The number of problems and the solving time were reduced accordingly: 12 problems in 30 minutes, so that our little participants do not get tired or lose concentration and interest. The problems booklets are brightly illustrated and each problem is accompanied by pictures.

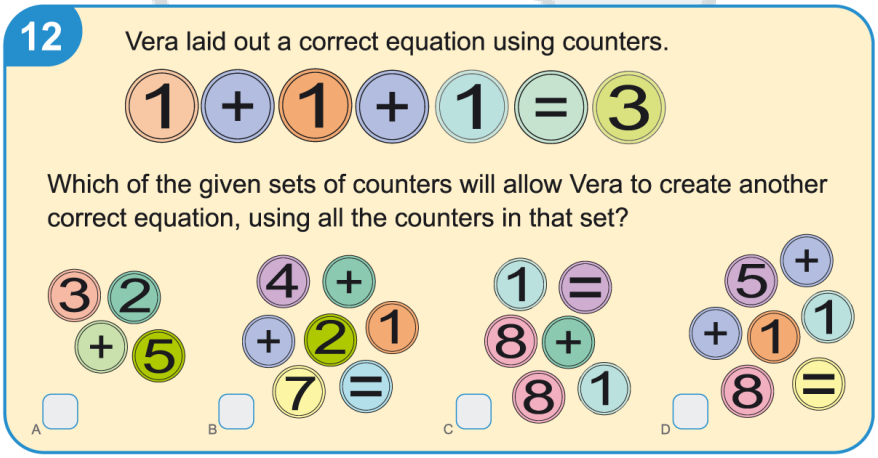
We also preserved the familiar Kangaroo scoring system. Kanguryonok problems are worth 3, 4, or 5 points. The 3-point problems require no special mathematical knowledge, meaning every child can solve them. This is wonderful because in Kanguryonok no child has ever scored zero points - every participant solves at least a few of the first problems. A zero score could easily upset a young child and discourage them from participating in future activities.

Example of a 3-point problem:



On the other hand the 5-point problems require basic early mathematical skills yet are still carefully adapted to the abilities of older preschoolers.

Example of a 5-point problem:



Because children of this age are very sensitive we removed the competitive aspect entirely. All participants receive the same prizes: one gift on the day they complete the game and another when the results are announced. As a result Kanguryonok brings only positive emotions. Later when they participate in the Kangaroo competition at school they will remember this pleasant experience.

Each child also receives a colorful certificate indicating the number of points they earned. There are no winner's diplomas because there are no winners in the game. Every certificate reads: Well done!. After all if there are no winners there are no losers. This is especially important for young children as it helps them feel confident regardless of the result. At the same time the certificate becomes part of the child's portfolio for school admission. A high score may be meaningful, for instance, when applying to a private school with a mathematics focus.

In addition, for parents Kanguryonok is an opportunity to test their child's knowledge, creativity and perseverance in a gentle age-appropriate way.

However, Kanguryonok has become popular not only with children and families but also with kindergarten teachers. For them it is a wonderful way to enrich group activities, support children's development and prepare them for school in a smooth and enjoyable manner. In some kindergartens the game becomes a festive mathematics day and the announcement of results and prize-giving turns into a special event for the children.

In Russia children generally start school at age 7. Therefore first-graders also take part in Kanguryonok. The game is held in December giving them excellent preparation for the Kangaroo competition that awaits them in March. A seven-year-old encountering the Kangaroo task format for the first time might feel confused or not fully understand the rules. But if they took part in a similar activity a few months earlier they approach the competition with much greater confidence as they are already familiar with the format.

This December Kanguryonok was held in our country for the third time. Responding to numerous requests from parents this year we are also introducing the opportunity to participate not only in person at kindergartens and schools but also online on our website.

If you are interested in organizing the Kanguryonok Mathematical Game for children in your country as well we would be delighted to share our experience. It would be great if every big brother Kangaroo had its own little sibling Joey!

Ekaterina Alekseeva

Kangaroo Russia

UGANDAN STUDENTS PARTICIPATE IN KANGAROO MATHEMATICS CAMP HOSTED AT BOĞAZİÇİ UNIVERSITY/ İSTANBUL - TÜRKİYE FROM TUESDAY JULY 01, TO TUESDAY JULY 08, 2025.

Part II

Simon Awuyo
awuyosimon@gmail.com

A team of four students and a teacher advisor Simon Awuyo Ecegeri was sponsored AKSF for Kangaroo Mathematics Camp organized by Turkey Kangaroo Mathematics Association. Ugandan students are Amanya Christine and Nakya Myra Catherine from Trinity College Nabbingo, Kinya Godber Nobert from Makerere College School and Onanyang Joseph from Kololo Senior Secondary School.

IMPACT OF THE ONE WEEK KANGAROO MATHEMATICS CAMP IN TURKEY ISTANBUL, JULY 01 TO 08, 2025

1. Parents and Schools represented were very proud and rejoiced, congratulated and honoured their students during school Assembly time.
2. After posting the highlights of the events during the Mathematics Camp in Turkey all of sudden teachers on My Tutor chat WhatsApp platform started sending messages to me and imploring about opportunities of future Mathematics Camps. This is the beginning of the impact the Mathematics Camp in Turkey Istanbul having positive influence of Kangaroo Mathematics Association in Uganda. With continued support accorded to Uganda by AKSF to participate in Mathematics Camps in foreign Nations, revival will spark resulting permanent revolution in popularization of Mathematics in Uganda.
3. These can be backed up by incentives to very highly performing students.
4. Organizing workshops for teachers and students both jointly and separately will enhance performance in national Examinations in Mathematics and STEM subjects.
5. Ultimately there will be positive attitude cultivation in schools and institutions towards Mathematics resulting into revolutionizing not only the schools but also the society leading to improved quality of living in Uganda.

APPRECIATION

On behalf of Glee Pearl Stem Initiative Ltd. I hereby convey our sincere and heartfelt gratitude to:

1. The Board of Directors of AKSF for Sponsoring the team of 4 students and one teacher advisor for the Kangaroo Mathematics Camp in Turkey Istanbul this year 2025. The participation of Ugandan students in the Worldwide Kangaroo Mathematics Camp in Türkiye has shocked many parents, School teachers, managers and administrators in Uganda. Some schools and teachers who frustrated the efforts of Glee Pearl Stem Initiative Ltd. representing AKSF in Uganda are now seeking opportunities of apologizing and reconciling so that their students don't miss the subsequent opportunities. With continued support by AKSF there will be evident paradigm shift in the attitude of learners towards mathematics in Uganda.
2. I thank Mr. and Mrs. Özdemir with the entire team of organizers of the Mathematics Camp in Türkiye Istanbul for the great work they did in imparting knowledge, skills and valuable unique experiences in the life of our students from Uganda.

God Bless you.

Simon Awuyo Ecegeri.

And here an uplifting letter from Joseph, one of the Ugandan Camp participants:

By Joseph Onanyang Kololo Senior Secondary School, Uganda.

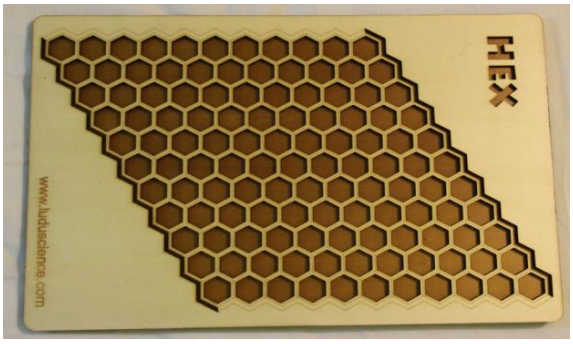
Istanbul math contest camp; nurturing young mathematical talent

Discovering math brilliance and intelligence from young minds across the world.

Developing young talents in math and knowledge of how to solve mathematical puzzles and different mathematical games.

Before this camp, I used to solve mathematical questions and problems using My tutor chat website though I was never used to solving mathematical puzzles and games and also little did I know about mathematical games for example hex game, chess and many more. My experience in solving logical numbers in mathematics was also low before the Kangaroo Mathematics Camp in Istanbul, Turkey.

After this camp, I acquired lots of ideas of solving Mathematical problems, playing games and puzzles and interacting with different young minds. During this camp, I have also learned to play different games full of mathematical analysis, reasoning logically and thinking critically for example hex game, chess and many more.



During this camp, we had social interactions with different students from different countries for example Israel, Poland, Turkiye Tunisia and others. We shared different experiences together on how to solve mathematical questions, logical games and also exchanged different knowledge on different Math numbers.

My advice to students in different schools around the world is that, they should have love for mathematical games logical games and numbers because they boost knowledge and understanding of daily mathematical knowledge. I would also love to assure them to have time and practice Mathematics through My tutor chat which we very much rely on in Uganda.

Particularly, for Ugandan students, this can work better with the new curriculum mathematics since it is full of reasoning and logical ideas which will help to widen and boost the reasoning capacity and ideology.

I would like to give special thanks to the organizers of this Camp, first of all Mr. Özgür Özdemir the general coordinator, Mr. Awuyo Simon our Ugandan coordinator and others I have not mentioned, my special thanks goes to you all.

And here an uplifting letter from Nankya, one of the Ugandan Camp participants:

By Nankya Myra catherine from Trinity College Nabbingo

My name is NANKYA MYRA, an S1 student who attended the Kangaroo Math Camp in Istanbul-Turkey I thank God for the chance I received to be able to travel abroad and broaden my Mathematics. In the beginning it was quite hectic since I had to be picked from school for the passport procession and then the visa which took quite a long time but it was all worth it. We travelled to Turkey on 1st July at around 4am and reached on 2nd at around 2pm. We were humbly welcomed by the professor and we settled in. From 3rd to 6th , we had interesting math lectures for half a day then rest of the day, we would have fun but tricky math puzzles. We learnt problems like the lockers problem, the apartment problem and puzzles or games like sudoku , the hex game etc. For the weekend, we were given a tour of the beautiful city Istanbul and a visit to the mall and beach which was so exciting. This math camp helped me a lot because I got even better in my Mathematics when I got back at school. It also gave me an experience of being able to step out of country, board a plane and also eat foreign food. I encourage students to practice from the my tutor.chat website to practice and be able to excel in the Kangaroo Math Contest of the years to come.

Yours faithfully,

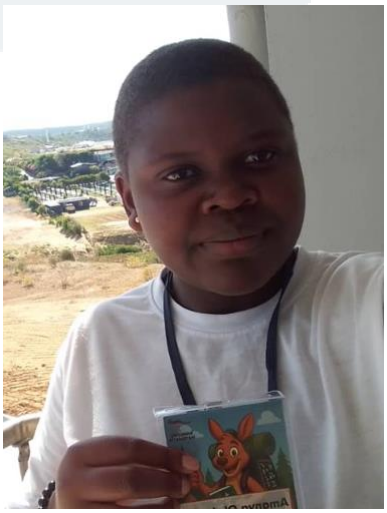
And here an uplifting letter from Amanya, one of the Ugandan Camp participants:

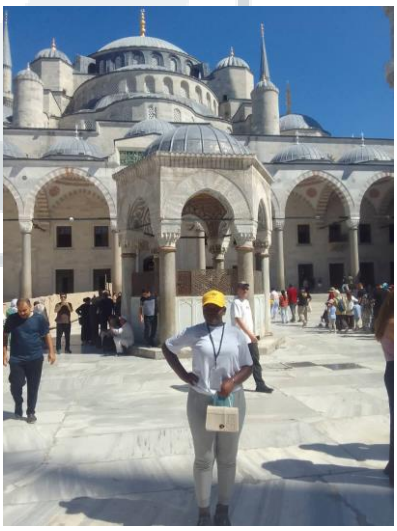
The mathematics summer camp started off with our arrival at Boğaziçi Üniversitesi on 1st July at a half past one in the afternoon. We were warmly received and allocated our rooms where we were to stay during the camp, after which we were led to lunch. That evening, the first camp meeting was held to brief us about the dos and don'ts.

We were thirty-four participants from various nations, i.e. Uganda, Turkey, Poland, Tunisia and Azarbaijan. During our stay at the university, a lot of activities were carried out to equip us with mathematical problem-solving skills. These included mathematics lecturers which were accompanied by two tests, games like HEX that taught one how to strategies and puzzles that sharpened our minds to analyze, critically think and conclude accordingly in the shortest time possible. The activities were not only educational but also fun.

On Saturday 5th, we had a city tour around Istanbul and took in the scenery, traditions and customs. We also trekked on Sunday morning to freshen up and went to the beach at the Black sea twice to relax our minds.

The camp was crowned with an awarding ceremony on 7th after dinner. Every talented participant was presented a special gift and a Certificate Of Participation. Not forgetting, there was recognition of outstanding participants who performed exceptionally well in the puzzle and game tournaments as well as the tests. The following day, we were escorted to catch our flight back to Uganda. In conclusion, it wa s a great experience, which taught me that learning is best when its active and I am forever grateful to the Association for the opportunity I was granted to experience exposure to a world of studying mathematics enthusiastically.





I enjoyed the city tour as we entered one of the greatest mosques, also enjoyed ice cream in form of an incentive for solving a puzzle successfully. Another day at the beach to relax after puzzle session.

AI Generated Infographics on the «Impact of Math Games and Competitions on Children's Achievement»

Important dates for the 2025/26 season

Kangaroo day	Thursday, March 19, 2026