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ABOUT THE ENDRE VINCZE I. MEMORIAL MATHEMATICS COMPETITION

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Abstract

The Endre Vincze Mathematical Memorial Competition was launched in 2024 at the University of Miskolc. The competition aims both to provide students with an opportunity to test their mathematical skills and to honor the memory of Dr. Endre Vincze, an outstanding former professor at the university. The Endre Vincze Mathematical Memorial Competition provides an excellent opportunity for talent development, the identification of outstanding abilities, and the strengthening of professional motivation. The challenging problems and the competitive environment can encourage students to engage with mathematics beyond the mandatory curriculum and to remain open to scientific problems. This paper outlines the competition's concept, the methodology used to develop the problems, and the initial experiences from the event.*

1 Introduction

The Endre Vincze Mathematical Memorial Competition was launched at the University of Miskolc in 2024. The initiative was established, on the one hand, to provide students with an opportunity for mathematical competition—a need identified through feedback—and, on the other, to honor the memory of Endre Vincze, an outstanding former professor at the university.

2 Characteristics of the Mathematical Competition

The competition problems are designed to cover a broad spectrum of mathematics, including analysis, algebra, geometry, number theory, probability theory, and more. The difficulty level of the problems ranges from basic to advanced. We generally aim to include problems that allow for simple and elegant solutions. The problem sets contain a relatively large number of tasks; this is primarily for pedagogical reasons: it is highly likely that a participating student will be able to solve at least some of them,

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ensuring a sense of achievement—even if they do not ultimately place in the competition. We consider this sense of achievement crucial, as it helps students maintain their enthusiasm, making them more likely to participate in future competitions. More importantly, it fosters a positive attitude toward mathematics, which proves beneficial throughout their university-level mathematical studies.

We have observed an increasing number of students signing up for the competition (at the time of writing, the second series has already concluded, and the third is set to take place soon). Naturally, participation is entirely voluntary.

It is also worth noting that, before each competition, we take the time to speak about the work and the personal character of Professor Endre Vincze, the competition's namesake.

The competitions held so far have been characterized by a positive atmosphere—a significant detail, as this made the process of solving mathematical problems feel more accessible. This positive environment was, in fact, intentionally cultivated, and successfully so. It should be noted that the competition concludes with a formal awards ceremony, where top-placed participants receive valuable prizes, and special awards are also presented. A distinctive feature of the competition is a mug bearing the portrait of Professor Endre Vincze (see Figure 1). This item is unique in several respects: the color of the inscription changes each year (this also applies to the problem set itself—in 2024, it was red), and it features a different mathematical formula every year.



Figure 1: Mug with a portrait of Professor Endre Vincze.

3 Worksheet of the I. Endre Vincze Memorial Mathematics Competition

Below, we present the exercises from the I. Endre Vincze Memorial Mathematics Competition.

I. ENDRE VINCZE MEMORIAL MATHEMATICS COMPETITION

UNIVERSITY OF MISKOLC

October 17, 2024

Name:.....

Neptun ID:.....

Exercise 1

In how many ways can a unit cube be cut by a plane such that the resulting cross-section is a regular hexagon?

What is the area of the resulting regular hexagons?

(10 points)

Exercise 2

Premises:

There are no animals in this house other than cats.

We are happy to pet any animal that likes to gaze at the moon.

I avoid any animal that I hate.

There is no carnivorous animal that does not howl at night.

There is no cat that does not catch mice.

No animal befriends me, except for those in this house.

We are not fond of petting kangaroos.

Only carnivorous animals catch mice.

I hate any animal that does not befriend me.

Animals that howl at night like to gaze at the moon.

Does it follow from these premises that I avoid kangaroos? (A problem by Lewis Carroll)

(10 points)

Exercise 3

A dart is thrown randomly at a unit square. What is the probability that the point of impact is at a distance of less than 1 from the bottom-left corner of the square?

(10 points)

Exercise 4

Determine all polynomials of degree at most 3 for which the points -1, 0, and 1 are fixed points—that is, $p(-1) = -1$, $p(0) = 0$, $p(1) = 1$!

(10 points)

Exercise 5

How many four-digit numbers are there that leave a remainder of 42 when divided by 99? What is the sum of these numbers?

(10 points)

Score achieved:.....

4 Some remark of exercises

The worksheet is structured such that simpler exercises appear at the beginning, followed by more complex ones.

Let us first consider the first exercise:

Exercise 1

In how many ways can a unit cube be intersected by a plane so that the resulting cross-section is a regular hexagon?

What is the area of the regular hexagons obtained in this way?

The first exercise is essentially a warm-up exercise. Its pedagogical value lies in providing the student participating in the competition with a sense of success, thereby giving them momentum to tackle the remaining problems.

Let us consider the second exercise.

Exercise 2

Premises:

There are no animals in this house other than cats.

We enjoy petting any animal that likes to gaze at the moon.

I avoid any animal that I hate.

There is no carnivorous animal that does not howl at night.

There is no cat that does not catch mice.

No animal befriends me, except for those in this house.

We do not enjoy petting kangaroos.

Only carnivorous animals catch mice.

I hate animals that do not befriend me.

Animals that howl at night like to gaze at the moon.

Does it follow from these premises that I avoid kangaroos? (An exercise by Lewis Carroll [1], [2])

Although the second exercise consists of many simple parts, it is quite complex as a whole. Reaching the correct solution requires a greater effort from the contestant. However, students generally overcome this difficulty, aided by the sense of success and momentum gained from the first problem.

Let us consider the third exercise.

Exercise 3

A dart is thrown randomly at a square with a side length of 1. What is the probability that the point of impact is at a distance of less than 1 from the bottom-left corner of the square? The third task can be considered more complex than the previous two; its level of difficulty is higher because solving it requires some knowledge of both geometry and probability theory.

Let’s look at the fourth exercise.

Exercise 4

Determine all polynomials of degree at most 3 for which the points −1, 0, and 1 are fixed points—that is, $p(-1) = -1$, $p(0) = 0$, $p(1) = 1$!

At first glance, the fourth exercise might seem difficult to solve; after all, one must identify all such polynomials, and only their fixed points are known. However, this problem serves as a classic example of how—after an initial, often discouraging feeling that the problem might be "unsolvable"—the mind begins to engage, connections are made, and a solution typically emerges.

Let’s look at the fifth exercise.

Exercise 5

How many four-digit numbers leave a remainder of 42 when divided by 99? What is the sum of these numbers?

This exercise is a perfect illustration of how a mathematical challenge can be solved through a relatively straightforward line of reasoning. In a sense, it serves as a culmination of the first four exercises.

5 Competition results

The I. Endre Vincze Memorial Mathematics Competition drew significant interest. Most of the participants successfully solved the assigned problems. The competition was won by Ábel Fodor, a second-year mechanical engineering student; Zsolt Nyiri took second place, and Roland Bátor finished third—both of whom are also mechanical engineering students.



Figure 2: In the photo, from right to left: Dr. habil. Zsuzsanna Óváriné Balajti, Bencze Bakos (special prize winner), Zsolt Nyiri (2nd place), Ábel Fodor (1st place), Roland Bátor (3rd place), and competition organizer Dr. József Túri.

6 Summary

The Endre Vincze Memorial Mathematics Competition was launched at the University of Miskolc in 2024. The competition aims to provide a mathematical challenge for university students while honoring the memory of Endre Vincze, a highly respected late professor of the university.

The problems cover a broad spectrum of mathematics, including analysis, algebra, geometry, number theory, and probability theory. They range in difficulty from foundational to advanced levels. Solving them requires more than just the application of routine procedures; it demands independent thought, the discovery of new approaches, logical reasoning, and creativity. The problem set was carefully curated to include more accessible tasks, ensuring that students can experience a sense of achievement.

A key objective is for participants to gain positive experiences, become more motivated, and develop a favorable attitude toward mathematics.

The Endre Vincze Memorial Mathematics Competition serves as an excellent platform for talent development: through complex problems that require creative, problem-solving thinking [3], [4], the most gifted students can demonstrate their knowledge and aptitude [5]. In this way, the competition helps to discover and nurture talents who might otherwise find it more difficult to stand out within a traditional academic framework [6]. The competition provides an opportunity to identify and develop exceptional abilities, strengthen professional motivation, and build a community committed to nurturing talent. Challenging tasks and a competitive spirit can encourage students to engage with mathematics beyond the mandatory curriculum and remain open to scientific problems.

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