2026 High School Math Contest

Presented by the IU Indianapolis Department of Mathematical Sciences & the School of Science

Submission Date: **March 9th, 2026** **Awards Ceremony: April 24th, 2026** Keynote Speaker: **Dr. Andrei Martinez-Finkelshtein**

Individual Problems

Students must work on their own when solving Problems 1-5. They cannot receive help from their friends, teachers, AI assistance, or the internet.

Problem 1

Let R be a disk and $ABCD$ be a quadrilateral in R with vertices A, B, C, and D that lie on the boundary of R. In addition, the diagonal AC forms a diameter of R. For each side of the quadrilateral, AB, BC, CD, and DA, construct semicircles that have the corresponding side as a base and lie outside the quadrilateral. Call these regions R_{AB}, R_{BC}, R_{CD}, and R_{DA}. Show that the area of the region $(R_{AB} \cup R_{BC} \cup R_{CD} \cup R_{DA}) \setminus R$ is equal to the area of the quadrilateral $ABCD$.

Problem 2

Let $p(x) = ax^2 + bx + c$ be a polynomial such that $|p(x)| \leq 1$ for each $x \in [-1, 1]$. Show that $|q(x)| \leq 2$ for each $x \in [-1, 1]$, where $q(x) = cx^2 + bx + a$. Can $|q(x)| = 2$ for some $x \in [-1, 1]$?

Problem 3

Solve these problems using mathematical reasoning (and not a computational search):

(a) *Find the smallest perfect square that ends in 99 (both one's and ten's places have a 9).*

(b) *Find the smallest perfect cube that ends in 99.*

Problem 4

Jeopardy will host a "Month with the Champions" tournament. The same three contestants, A, B, and C, will play each weekday. In any contest, the chances of winning for A, B, and C are 40%, 35% and 25%, respectively.

(a) *By the end of the first week (5 contests), what is the chance that A is leading?*

(b) *By the end of the month (20 contests), what is the chance that A is the winner?*

Computer coding is allowed in this problem.

Problem 5

Triangle ABC has $A = (0, 0)$, $B = (10, 0)$, and the orthocenter $H = (3, 4)$. Find its incenter I.

Team Problem

Solve 1! Solve some! Solve all!

Be sure to tell us your reasoning and cite sources.

***Do it by March 9th** and follow all rules on the website.*

(a) *Consider the function $f(x) = 2x^2 - 1$ on the interval $[-1, 1]$. Define $x_{n+1} = f(x_n)$, and consider the following set of values for x_0:*

$$0, 1, \tfrac{1}{2}, \tfrac{\sqrt{2}}{2}, \tfrac{\sqrt{3}}{2}, \tfrac{\sqrt{6}-\sqrt{2}}{4}, \tfrac{\sqrt{5}-1}{4}.$$

Describe the behavior of x_n as a function of n in each case. Now consider an arbitrary value of x_0 on $[-1, 1]$. Can you determine x_n as a function of x_0?

(b) *Next consider the function $f(x) = 3x - 4x^3$ on the interval $[-1, 1]$ and, perhaps by studying the same set of initial values, try to determine the behavior of an arbitrary x_n as a function of x_0.*

(c) *Other functions to explore are $f(x) = 2x\sqrt{1 - x^2}$ on $[-1, 1]$, $f(x) = 2x/(1 - x^2)$ on $(-\infty, \infty)$, $4x - 4x^2$ on $[0, 1]$, and $x^2 + 2x$ on the interval $(0, \infty)$.*

The set of initial values originally provided may or may not be useful with these functions, so you may need to explore other values of x_0 to determine the behavior of these functions.

Can you generalize this behavior?

The awards ceremony for participants, friends, and family to recognize the achievements of the winners will be held on April 24th at the IU Indianapolis Campus

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Office of Jay Gladden
Provost & Executive Vice Chancellor

Prizes

One 1st place prize $300 and a full 4-year tuition scholarship

up to Five 2nd place prizes • $200 each and a $2,500/year scholarship

up to Ten 3rd place prizes • $100 each and a $2,500/year scholarship

Scholarship details posted on our website

https://sites.google.com/iu.edu/math-contest

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