Maróthi György Memorial Competition, October 17 – November 21, 2025.

– Rules –

Description

The Institute of Mathematics of the University of Debrecen announces a competition in Mathematics for BSc students of the University of Debrecen in their first or second year of studies during the fall semester of the academic year 2025/2026. The competition is individual, registration is not required. The list of problems is published at noon on October 17, on the web page of the Institute:

`https://math.unideb.hu`

Available at: Hallgatóknak » Tehetséggondozás » Versenyek » Maróthi György Memorial Competition

Organizers

dr. Zoltán Boros	*(Inst. Coordinator of Talent Management, Department of Analysis, UD)*
dr. Mihály Bessenyei	*(Competition Secretary, Department of Analysis, UM)*
dr. Gábor Nyul	*(Department of Algebra and Number Theory, UD)*
dr. Márk Oláh	*(Department of Geometry UD)*

Sponsorship

Organizers thank the financial support by the Morgan Stanley Magyarország Elemző Kft.

Formal requirements

Solutions to distinct problems should be elaborated on separate sheets of paper. Write your name, major, year, neptun code and the number of the problem which is elaborated on that sheet to the top of the page. The pdf file of the hand written solutions have to be sent by email to Zoltán Boros and Mihály Bessenyei:

`zboros@science.unideb.hu` and `besse@science.unideb.hu`.

Deadline for submission: November 21 (Friday), 2025, 12:00.

Ethical regulation

Though all problems can be solved using standard college mathematics, you can use any additional sources if it is appropriately cited in your solution. Cooperation of the participants (with each other or with any other person on any platform) is not allowed. If such a cooperation is established, all involved participants will be disqualified.

Every participant will be notified of his/her result.

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– Problems –

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1. Problem. *Given* 2025 *distinct points in the plane, prove that there is a line that contains exactly one of these points and that each of the half-planes defined by it contains* 1012 *points!*

(Posed by Mihály Bessenyei)

2. Problem. *What are the functions* $f\colon]0,1[\to\mathbb{R}$ *for which the equation* $f(xy)=xf(x)+yf(y)$ *holds for all* $x,y\in]0,1[$*?*

(Posed by Mihály Bessenyei)

3. Problem. *Find all pairs of twin primes* (p,q) *(positive prime numbers* p,q *satisfying* $q-p=2$*) for which the result of writing the decimal representations of* q *and* q^2+16 *together is also a prime number.*

(Posed by Gábor Nyul)

4. Problem. *In how many ways can a convex* 30*-gon be divided into triangles by drawing non-crossing diagonals, such that each triangle has a side in common with the* 30*-gon?*

(Posed by Gábor Nyul)

5. Problem. *Consider a triangle* $ABC\triangle$*. On the ray of the line* $\overleftrightarrow{BC}$ *starting at* C *and not containing* B*, pick a point* D *such that the lengths of the segments* CD *and* BC *are equal. Furthermore, on the ray of the line* $\overleftrightarrow{AC}$ *starting at* A *and not containing* C*, pick a point* E *such that the length of segment* AE *is twice the length of side* AC*. Show that if the lengths of* AD *and* BE *are equal, then* $ABC\triangle$ *is a right triangle.*

(Posed by Márk Oláh)

6. Problem. *Consider an isosceles triangle* $ABC\triangle$ *with sides* $AB=AC$*. Denote the intersection of the angle bisector of angle* $\measuredangle BAC$ *with the opposite side by* D*, and the intersection of the angle bisector of angle* $\measuredangle ABC$ *with the opposite side by* E*. Let* K *be the center of the inscribed circle of* $ADC\triangle$*. Supposing* $\measuredangle BEK=45^\circ$*, what is the measure of the angle* $\measuredangle BAC$*?*

(Posed by Márk Oláh)

Solution to each problem is evaluated up to 5 points.
The order of the problems need not indicate their difficulty.