written on 2023 cards. Then the cards are dropped in an urn, and one card is pulled out at random. If the number on the card equals 2/3 of the mean of the numbers on all the cards then we will win as much money as the number on the card pulled out. Otherwise we do not win anything. What numbers should be written on the cards so that the expected value of the money gained is a maximum? (*5 points*) (Proposed by *B. Dura-Kovács,* Garching) **B. 5324.** Arthur and Barbara are playing the following game: they take turns in writing down a digit, proceeding left to right, until they obtain a 2023-digit number. Arthur starts the game, with a nonzero digit. Arthur will win if the resulting number has a divisor of the form $1\overbrace{7\dots7}^{n \text{ pcs } 7}$ $(n \geqslant 1)$. Otherwise Barbara wins. Which of them has a winning strategy? (*6 points*) (Based on the idea of *G. Kós,* Budapest) **B. 5325.** Determine all bounded convex polyhedra such that the planes of the faces divide the space into $c+e+\ell+1$ regions, where c, e and ℓ, respectively, stand for the number of vertices, edges and faces. (*6 points*) (Proposed by *V. Vígh,* Sándorfalva)

New problems – competition A (see page 290): **A. 854.** Prove that $\sum_{k=0}^{n} \frac{2^{2^k} \cdot 2^{k+1}}{2^{2^k}+3^{2^k}} < 4$ holds for all positive integers n. (Submitted by *Béla Kovács,* Szatmárnémeti) **A. 855.** In scalene triangle ABC the shortest side is BC. Let points M and N be chosen on sides AB and AC, respectively, such that $BM=CN=BC$. Let I and O denote the incenter and circumcentre of triangle ABC, and let D and E denote the incenter and circumcenter of triangle AMN. Prove that lines IO and DE intersect each other on the circumcircle of triangle ABC. (Submitted by *Luu Dong,* Vietnam) **A. 856.** In a rock-paper-scissors round robin tournament any two contestants play against each other ten times in a row. Each contestant has a favourite strategy, which is a fixed sequence of ten hands (for example, RRSPPRSPPS), which they play against all other contestants. At the end of the tournament it turned out that every player won at least one hand (out of the ten) against any other player. Prove that at most 1024 contestants participated in the tournament. (Submitted by *Dávid Matolcsi,* Budapest)

Problems in Physics

(see page 314)

M. 423. There is a 100-forint coin, initially at rest, on a horizontal tabletop. Send another 100-forint coin to slide along the tabletop such that it undergoes head on collision with the stationary one. Measure the distances covered by the two coins after the collision until they stop. From the measured data determine the *coefficient of restitution* which is a number to characterise the inelasticity of the collision. Does the coefficient of restitution depend on the relative velocity of the colliding objects?

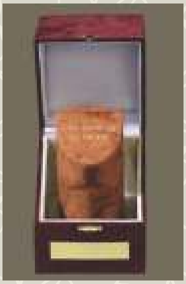
G. 817. The James Webb space telescope orbits the so-called L_2 Lagrange point of the Sun-Earth system. This point is located 1.5 million km from Earth along the line connecting the centres of the Sun and the Earth, beyond the Earth. Imagine that you are exactly at the L_2 Lagrange point, looking towards the Sun. Do we need goggles? What do we see? **G. 818.** An open railway wagon is travelling on a horizontal straight track at a speed of v. With a cannon in the immediate vicinity of the railroad track, a projectile is fired at a speed of $2v$ at the moment when the end of the wagon passes the cannon. At what angle to the horizontal should the cannon fire its projectile so that it strikes the end of the wagon? How long after firing does the projectile fall back? (Neglect air resistance.) **G. 819.** The *figure* shows three tanks, to which drain tubes are attached, and they all contain the same liquid. Which tank will drain the fastest if the internal friction (viscosity) of the liquid is negligible? Is it sure that the middle tank can even become empty, if the lowest point of the drain tube gets to a very low position? Is it sure that the right tank can even become empty, if the highest point of the drain tube gets to a very high position? **G. 820.** Each resistor in the circuit shown in the *figure* has a resistance of 6 kΩ and the voltage of the battery is $U = 60$ V. How many times more heat is dissipated in the resistor that heats up the most than in the one that heats up the least?

P. 5490. The dual carriageway road considered in this problem has two lanes for traffic going in each direction. The average distance between cars on each lane of the dual carriageway at peak times is 150 m. The average time to pass through the toll gates is 10 seconds for entering and 20 seconds for exiting. How many gates would be needed on one side and on the other to avoid congestion even at rush hour? (The average speed of the cars is 100 km/h.) **P. 5491.** A small body starting from rest at a given point in space can slide down along slopes of different angles of inclination. What is the locus of that points of the slopes, in space, at which the values of the dissipated heat due to friction are equal? **P. 5492.** Two identical bodies, each of mass m, are connected by a flexible rubber thread, threaded through a stationary pulley of negligible mass. The bodies are held in the position shown in the *figure* – at this position the rubber band is unstretched – and then body B is released without initial velocity. Body A loses the contact with the table at time t_0 after the release of body B. *a*) What is the displacement of body B at time $t = t_0$? *b*) How long after the start will the velocity of body B be zero for the first time? *c*) What is the maximum tension exerted in the rubber thread during the motion? **P. 5493.** The James Webb space telescope orbits the Sun, near the so-called L_2 Lagrange point, synchronously with Earth. This point is located 1.5 million km from Earth along the Sun-Earth line, beyond the Earth, and is notable (along with the other Lagrange points) for the fact that bodies placed there "more or less" remain there "at the same position" as they move with the Earth. Show by a simple calculation that the L_2 Lagrange point is really that far from the Earth. **P. 5494.** The "double yo-yo" shown in the *figure* consists of two identical discs of uniform density and the threads wound on them. The two bodies are released from rest such that the threads are vertical. How long does it take to unwind the thread from the lower disc, if its length is 80 cm? **P. 5495.** A resistor of resistance $R = 100\ \Omega$, a coil of inductance $L = 1$ mH and a capacitor of capacitance $C = 10\ \mu$F are connected as shown in the *figure*. A sinusoidal voltage supply of frequency $f = 50$ Hz is connected to two of the points 1, 2, and 3. In which of the three cases will the heat dissipated in the resistor be the greatest? **P. 5496.** A laser beam of diameter 5 mm is incident on the reflecting surface of the wall of a cylinder of diameter 10 cm, as shown in the figure. A screen is placed perpendicular to the reflected laser beam so that the distance between the reflection point and the screen is 20 cm. What is the shape and size of the light spot on the screen? **P. 5497.** Consider the Thomson model of the hydrogen atom. The radius of a hydrogen atom is about 50 pm. *a*) Where can the electron be in equilibrium? *b*) What is the frequency at which the electron oscillates around this equilibrium position? Into which region of the spectrum does the light of this frequency fall? **P. 5498.** A wedge of inclination angle α and height h was fixed to a trolley. The trolley can roll easily, and the total mass of the trolley and the wedge is M. At the bottom of the wedge there is a body of mass $m \ll M$ at rest. We want to get the small body up to the top of the wedge by accelerating the wedge with a constant horizontal force. *a*) What is the minimum work that we have to do in the process if friction is negligible? *b*) In the case of this minimum work, what is the force that we have to exert on the wedge, and how long does it take to raise the small body to the height of h? *Data:* $h = 1$ m; $M = 1$ kg; $\alpha = 30°$.

160 éve született Rátz László

Rátz László márvány emléktáblája a Budapest-Fasori Evangélikus Gimnáziumban

Wigner Jenő a dolgozószobájában, a falon Rátz László képével



A Rátz Tanár Úr Életműdíj kisplasztikája

AZ
INFINITEZIMÁLIS SZÁMÍTÁSOK
ELEMEI
A KÖZÉPISKOLÁBAN

RÁTZ LÁSZLÓ ÉS MIKOLA SÁNDOR

FRANKLIN-TÁRSULAT

A Mikola Sándorral közösen írt könyvének címlapja és egy oldal a könyvből

Nyári fizikatábor

2023. június 23. és június 29. között

Ismét megrendezzük a több évtizedes hagyományokkal rendelkező fizikatábort Dombóvár-Gunaras Üdülőfaluban, az apartman házakban és a hozzájuk tartozó zöldterületen. A táborba várjuk olyan fizika iránt nyitott tanulók jelentkezését a 9–12. évfolyamokról, akik tudják vállalni az aktív tábori részvételt a vele járó utazási viszontagságokkal együtt. Elsősorban a KöMaL feladat-megoldóit várjuk, de korlátozott számban más – a fizika iránt határozottan érdeklődő – diák is részt vehet a táborban, ha valamilyen versenyeredménye vagy a fizikatanárának ajánlása ezt alátámasztja.

A táborban (külön tanárokkal és programmal) részt vesz a nemzetközi matematikai diákolimpiára készülő „matematikus csapat” is, és az esti előadásokat (nemzetközileg is ismert előadókkal) közösen hallgathatjátok meg.

A táborba olyan határon túli magyar középiskolásokat is várunk, akik aktív KöMaL versenyzők, vagy a fizika iránt elkötelezett, más versenyeken eredményesen szereplő diákok. A Nemzeti Tehetség Program keretében elnyert 2.489.000 Ft pályázati forrás (NTP-TSZM-22-0116) biztosítja a tábor költségeinek nagyobbik részét (szállás + napi háromszori étkezés, fürdőbelépő, jutalmak, előadók tiszteletdíja stb).

Május közepén e-mailben küldjük el a diákoknak a tábori felhívást és a jelentkezési lapot, melyet azoknak kell elektronikusan visszaküldeniük, akik a nyári KöMaL Fizikatábor résztvevői akarnak lenni. A jelentkezési határidő: május 31. Túljelentkezés esetén a pontverseny pillanatnyi állása, illetve a beérkezett jelentkezések sorrendje lesz a mérvadó.

A KöMaL előfizetési árai a 2023/24-es tanévre

lapszám ár : 1250 Ft   BJMT tagoknak: 9900 Ft

együttesen megrendelt	*előfizetési ár személykenként*	*plusz ajándék példány*
1-9 db	10400 Ft	0 db
10-19 db	9900 Ft	1 vagy 2 db
20-29 db	9500 Ft	3 db
30-49 db	9000 Ft	4 vagy 5 db
50-	8500 Ft	6 vagy több db

A következő tanévre szóló megrendelésről a pontos információk várhatóan június elején kerülnek fel a honlapra.

Petőfi Kulturális Ügynökség
Nemzeti Együttműködési Alap
Nemzeti Kulturális Alap
Bethlen Gábor Alapkezelő Zrt.
Miniszterelnökség