E. and K. Mathematical Olympics

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Abstract

This paper discusses the contribution of the Association of Czech Mathematicians and Physicists to the cultivation of mathematical knowledge of students at secondary schools in Bohemia and Moravia from 1872 to 1918. The contribution consisted mostly in publishing exercises in the Journal for Cultivation of Mathematics and Physics; these exercises were solved by students and contributed to the improvement of their mathematical education. People, who have a merit in this matter, are mentioned, too. The paper also brings a few tasks, which were solved by talented students in the Journal for Cultivation of Mathematics and Physics.

1 Introduction

In the second half of the 19$^{\text{th}}$ century industry, agriculture and trade started to develop very quickly in Bohemia and Moravia. This boom required many technicians, officials, clerk accountants and so on. These people must have known mathematics very well. I'd like to let the readers know, how the Association of Czech Mathematicians and Physicists[1] took care of improving students' mathematics knowledge. Journal for Cultivation of Mathematics and Physics (edited by the Association), whose first volume was published in 1872, played a very important role. This Journal brought many articles, which were intelligible for secondary school students, various interesting matters etc. But the most valuable part in improving the knowledge of students consisted in the organization of something like a contemporary Mathematical Olympics. I have therefore called these activities E. and K. Mathematical Olympics.[2]

2 Brief history of the Olympics

Already in the first volume of the Journal, 30 mathematical and 26 physical exercises were published. The exercises were proposed by F. J. Studnička[3] — a well known Czech mathematician and the first editor-in-chief of the Journal. These exercises, especially in mathematics, were rather difficult. Some of them required the knowledge of differential equations, gamma function, determinants, matrices and so on. Solving these exercises could be brought by every reader (abonents) of the Journal. Especially students of High Technical Colleges

[1] The Association was established in 1869. The main aim of the Association was to support the education in mathematics and physics. The Association has never broken its activity and works till nowadays.

[2] E. means Emperor, K. means King. Public offices, institutions, schools etc. were in Austria-Hungary signed by an abbreviation *E. and K.*

[3] František Josef Studnička (1836–1903), Professor of mathematics at Charles University in Prague.

solved these exercises, but among the solvers we can find several students of secondary schools, too; for example Antonín Sucharda[4], later Professor at the Czech Technical University in Brno. A really difficult task, concerning an integral of a partial differential equation, was solved by Eduard Weyr[5], Professor of Prague University. Except common exercises, so called *valuable exercises* were published. Their best solvers could win ten golden ducats. Valuable exercises were published till 1897. While first such exercises were theoretical (regarding convergency of infinity series), further ones were exercises on a higher level. Instead of money, successful solvers obtained special books or textbooks published by the Association. As an example I can cite the following: *Studnička: Introduction to Higher Mathematics* and *Briot-Pšenička: Mechanical theory of the heat.* Since 1897 the best solvers could win the first, second and third prize, according to the overall number and quality of their solutions. In all cases, the winners obtained books dealing with mathematics or physics. Now I will return to the history of the Olympics. Unfortunately, in the following issues the number of exercises dropped till the sixth issue, where no exercise was published. Representatives of the Assotiation realized it would have been a big loss to stop this matter, so in the seventh volume 8 exercises in mathematics and 4 in physics were published and the tradition continued. Boom of the Olympics started during the times, when Augustin Pánek[6] was the editor-in-chief of the Journal (1885–1907). From forty to sixty exercises were published in each volume, the level of the exercises approached the knowledge of mathematics in the last classes of secondary schools. The number of authors was raising, too, among them teachers at secondary schools prevailed. When A. Pánek left the position of the editor-in-chief, a change took place in the Journal. Karel Petr[7] became an editor-in-chief of the mathematical part of the Journal, Bohumil Kučera[8] led the physical section. L. Červenka (teacher at a secondary school in Prague) and two years later Karel Rychlík[9] organized the Olympics. The Olympics survived even the World War I, although the number of exercises dropped, as well as the number of solvers. Many students solved exercises after joining the army. Unfortunately, Jaromír Mareš from Prague, really a successful solver and a talented student of mathematics, died at war. Olympics was mostly a boys-matter, especially at the beginning, because girls didn't study at grammar schools in Austria-Hungary. The first girl, who solved some exercises, was Miss Emanuela Holoubková from Prague (1886). The number of women increased especially at the beginning of the 20^{th} century, which was influenced by the liberalization at secondary schools in our country.

3 Authors of the exercises

Authors of the exercises were mostly teachers at grammar schools, above all since the 1880's. At the beginning, F. J. Studnička mainly proposed the exercises. Some tasks were taken from foreign journals, a few exercises were historical. As the most renowned author we can consider Alois Strnad (1852–1911), who published more than 500 exercises during his life. Except these exercises he wrote some textbooks on mathematics, about 30 papers (mostly published in Journal), and he was also the author of about 70 entries in the Otto's Encyclopedia. On the opposite side we can find for example František Jirsák (1864–1939) — the teacher at a basic school in Dobřenice. Jirsák was the author of 38 exercises. Except mathematics, he collaborated with Prof. Čáda on the research on children psychology, collected local legends and made toys of natural materials (chestnuts, cones, wood) which were exported to many

[4] Antonín Sucharda (1854–1907), Professor of mathematics at the Czech Technical University in Brno.
[5] Eduard Weyr (1852–1903), Professor of mathematics at Charles University in Prague.
[6] Augustin Pánek (1843–1908), Professor of mathematics at Charles University in Prague.
[7] Karel Petr (1868–1950), Professor of mathematics at Charles University in Prague
[8] Bohumil Kučera (1874–1921), Professor of physics at Charles University in Prague.
[9] Karel Rychlík (1885–1968), Professor of mathematics at the Technical University in Prague.

foreign countries (Soviet Union, USA, England, Sweden etc.). A few exercises were also published by Jan Svoboda, an official in a bank in Brno; unfortunately, I did not manage to find more details about this person. The majority of authors formerly participated in the Olympics as the students of secondary schools. The number of authors exceeded one hundred; we can find two women among them.

4 The solvers

During the years 1872–1918, about 1 500 people solved at least one exercise, majority of them studied at secondary schools. Girls, who solved exercises, studied mostly at schools which prepared lady-teachers, or at a special girl secondary school called Minerva. Especially at the beginning, university students solved exercises, too. Besides students of Technical Colleges and the Philosophical Faculty of Charles University, the students of Juristic and Theological faculties enjoyed solving mathematical problems, too. The best solvers were awarded mathematical books to intensify their knowledge. We cannot underestimate another thing, either. For every exercise, one of the students was brought out as the author of the solution. Works of such students were published in the Journal and their names became known all over the whole Czech mathematical public. Naturally, the names of all solvers were published, too. We will not exaggerate by stating that all good mathematicians in Bohemia and Moravia started their careers as solvers of tasks, which were published in the Journal. Among the solvers we can find the names, which were well-known at least in Bohemia and Moravia. We can mention Matyáš Lerch, Karel Petr, Antonín Pleskot, Karel Čupr, Bedřich Macků, Karel Rychlík, Karel Engliš, Bohuslav Hostinský etc. Others became teachers at secondary schools, or priests. At the end I would like to mention a few quite interesting things. The majority of solvers came from Bohemia and Moravia, but except these ones we can find solvers from other parts of Austria-Hungary, too, and a few solvers were even foreigners. Sometimes, predominantly at the beginning, it happened that none of the readers was able to solve a problem. Then usually the author brought its solution.

At the end of this section, let me mention a few points of interest. The famous Czech mathematician Matyáš Lerch[10] published only two tasks, which were too difficult for secondary school students; one of them is cited in the next section. Since only one student solved his tasks, he stopped this activity and did not publish any exercise more. Karel Čupr[11] was the best solver; he solved almost 100 percent tasks and three times he gained the first prize and once the second prize. Except above mentioned Karel Rychlík, exercises were successfully solved by his younger brother Vilém, later assistant at the Czech Technical University in Prague, and his sister Jana. She later married Václav Špála, a well-known Czech painter, and contrary to her brothers, she stopped pursuing mathematics. Five solvers were true aristocrats; August Count Wodzicky was a private student at a secondary school in Kosciełniki (now Polland), the other aristocrats were Czech.

5 Exercises

During the years 1872–1918, about 1500 exercises were published in the Journal. The great part of them concerned geometry, both construction and numerical. Geometry was taught much more than nowadays. People in charge realized the importance of geometry both for practice and development of a logical thinking. Further on, various types of equations were set forward, exercises on number theory and so on. The authors did their best to create the exercises appropriate for the practical life, where it was possible. Except tasks

[10] Matyáš Lerch (1860–1922), Professor at the University in Freiburg (Switzerland), later professor at the Czech Technical University in Brno and at the end Professor at Masaryk University in Brno.

[11] Karel Čupr (1183–1956), Professor of mathematics at the Czech Technical University in Brno. He started his career as an assistant of M. Lerch.

on mathematics, exercises on physics and descriptive geometry were published, too. At the beginning, the publishing exercises in that branches was irregular, since 1907 tasks in these branches were published regularly as separate parts. Now I put forward some examples of tasks.

1. Let m, p be positive integers, x an arbitrary number. Then

$$\sum_{a=0}^{p}(-1)^a\binom{p}{a}\binom{x-a}{m}=\begin{cases}0, & m<p\\ 1, & m=p\\ \binom{x-p}{m-p}, & m>p\end{cases}$$

   Prove it.
   Exercise 6, volume 18, Author M. Lerch.

2. We can see the statue of Charles IV from some distance under the angle $\alpha = 10^\circ 44'$, the pedestal under the angle $\beta = 6^\circ 29'$, if our eyes are in the same height as a foot of the statue. If we draw near by 30 m, we can see the pedestal under the angle $\gamma = 15^\circ 51'$. How tall are the statue and the pedestal?
   Exercise 40, volume 24, author Alois Strnad.

3. In which years of the next (20^{th}) Century will February have five Sundays?
   Exercise 49, volume 24, author Augustin Haas, student of the Faculty of Philosophy.

4. If n is even, then $11520 \mid n^2(n^2-4)(n^2-16)$. Prove it.
   Exercise 35, volume 31, author Rudolf Hruša, student of the Faculty of Philosophy, later secondary school teacher.

5. Which reciprocal equation of the 4^{th} degree has roots that represent successive terms of an arithmetical sequence?
   Exercise 22, volume 39, author Jar. Doležal, secondary school teacher.

6. Calculate volume the of a space, which is bounded by the Czech vault over oblong of sizes a, b.
   Exercise 29, volume 39, author Antonín Sýkora, secondary school teacher.

7. A six-digit number is formed by six different ciphers. Multiplying this number by 2, 3, 4, 5, 6, we obtain again a six-digit number, which is formed by the same ciphers. Which number is it?
   Exercise 5, volume 12, author Dr. K. (L. Kraus).

6 Conclusion

The aim of our contribution was to mention some of our predecessors, who played an important role in mathematics teaching at those times and to commemorate those, whose names might have fallen into oblivion. Those teachers put in some good work as far as teaching is concerned. They considered their job more or less a sort of mission without asking for extra money or respect. Their enthusiastic attitude towards teaching influenced and motivated students, which is the reason why the above mentioned mathematicians are still the ideal teachers for contemporary generation of teachers.

In spite of the fact that they have passed away and nobody brings flowers to their tombs, their works remain alive and teachers still might be inspired by them. Not only their works, but the most importantly their tasks are worth mentioning. At least, our students can check, whether they have a good command of mathematics, no less than their great-grandfathers had.

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