

## Mathematics Education for gifted students of the Specialized Scientific Study Center on Physics, Mathematics, Chemistry and Biology of Novosibirsk State University

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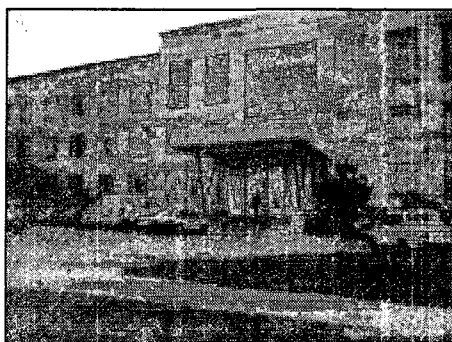
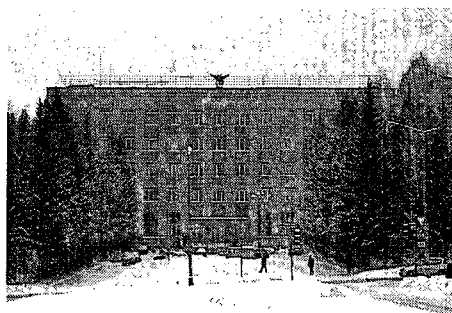
The Specialized Scientific Study Center (SSSC) - (<http://sscadm.nsu.ru/>) on Physics, Mathematics, Chemistry and Biology of Novosibirsk State University (NSU) is located in Novosibirsk, Russia.

Novosibirsk is Russia's third largest city with population about 1,5 million, after Moscow and Saint Petersburg, is located in the southwest of Siberia, at  $55^\circ \text{N } 83^\circ \text{E}$ .



It was founded in 1893 as the future site of the Trans-Siberian railway bridge crossing the great Siberian River Ob. The city lies along the Ob River in the West Siberian Plain.

Novosibirsk is the home of a number of scientific research institutes and one of Russia's best universities, situated in a nearby Akademgorodok, - Novosibirsk State University.



The Novosibirsk State University and Physical and Mathematical School are created first of all thanks to the first president of the Siberian Branch of the Russian Academy of sciences, the academician M. A. Lavrentev.

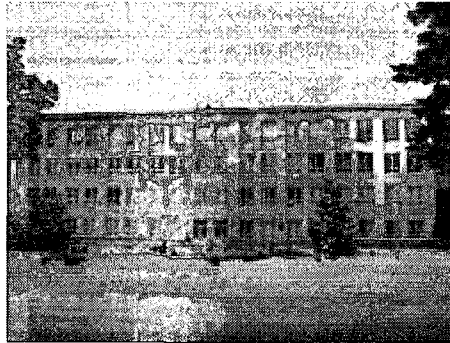


Academician Michael A. Lavrentev (1900 - 1980) was an outstanding scientist of the present - one of the main organizers and chairman of the Siberian Branch of the Russian Academy of sciences , 1957 - 1975, a member of some foreign Academies. Academician Michael A. Lavrentev was not only a scientist with a world name, but also an outstanding organizer of a science, the teacher and the tutor of youth.

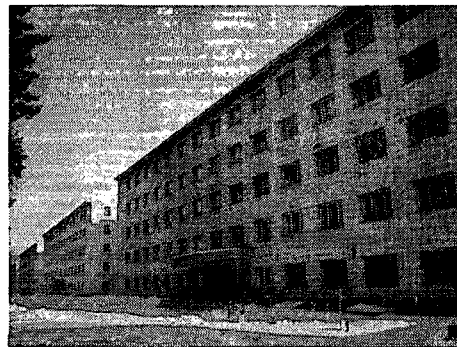
He has made in his life so much that it would suffice for some lives. He had been received brilliant results in the mathematics and in the mechanics, he had made for development of the Soviet aircraft construction very much. He has founded school on studying and practical use of

explosion (military and peace). But the main business of a life of M. A. Lavrentev - foundation of the Siberian Branch of the Academy of sciences (a new centre of science in the east of the country) in the 50-th of the last century.

Novosibirsk State University was opened in 1959



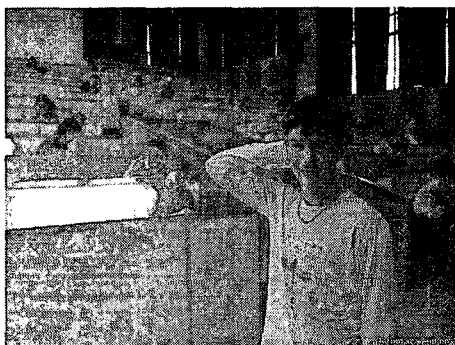
Novosibirsk Physical and Mathematical School started in January, 1963. Since next August Physical and Mathematical Schools in Moscow, Kiev, Leningrad and Novosibirsk have been officially opened in accordance with the resolution of the Council of Ministers of the USSR.



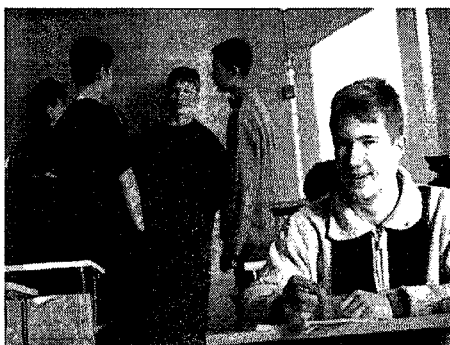
The SSSC of NSU was founded in 1988 on the base of M. A. Lavrentiev Physical and Mathematical School of NSU. It is a specialized high school. The special studies are carried out in mathematics, physics, chemistry, biology. In SSSC of NSU gifted children from all regions of Siberia, the Far East, republics of Central Asia are taught. The aim of the studies is to prepare future university students and direct their interests onto scientific work, to find and educate gifted children in all regions of the country over the Urals and in all layers of society.



The students training is conducted on the base of a common system that does not suppose an early narrow specialization. The training is carried out in accordance to the programs for high schools of Russia, but they are deepened for the main subjects: mathematics, physics, computer science, chemistry, biology, economics. Individual extended training for those who choose definite subjects from basic ones does not excluded. School training does not duplicate higher school courses but only prepares students for higher schools programs



The SSSC of NSU study is made to be maximum approximated to higher schools system of education, it includes a system of lecture courses and seminars accompanying these courses, students used to prepare essays on the subjects studied, they study profoundly computer science and personal computers usage, a system of special courses and special seminars is carefully developed.



One of the main aims of SSSC of NSU is to train creative abilities of its students. This aim is achieved by means of the system of special courses and seminars, lessons for solving non-standard problems of mathematics, physics, chemistry. Independent work of students is conducted during their spare time in hostels, laboratories, computer classes of SSSC of NSU.



In SSSC of NSU teaching is carried out on the base of specially developed programs that are broader than school ones and are aimed at serious independent work of students. Children occur in absolutely new conditions: they attend common division lectures, and on the lessons of physics, mathematics, chemistry and biology their classes are divided into groups for seminars conducting. Twice a year the students pass examinations on the main subjects.

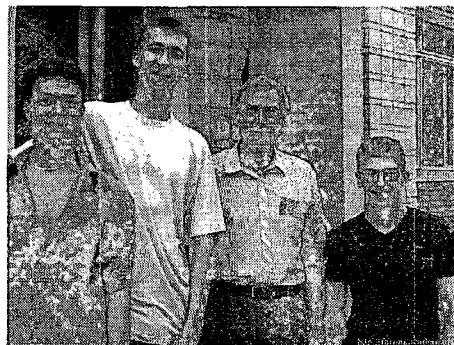
From the foundation SSSC has granted more than 10000 school-leaving certificates to students.

Every year the School is finished by more than 300 students.

More than 500 students are taught annually in SSSC of NSU.

The life of SSSC students is very intense, but fascinating and interesting. Wherever they were engaged - in study, sports, the organization of every possible celebratory representations and exhibitions, they are involved in real creation. As someone of SSSC's graduates has told "I have received scientific knowledge in detail at university. In our school I have acquired spirit of

a science, have felt an essence of mathematics, its beauty, have felt spirit of creativity.”



The system of selection of gifted children by means of Olympiads was developed and approved by the founders of Novosibirsk School of Physics and Mathematics in the early 1960s. Since then it has worked and given to the Physical and Mathematical School (now it is the Specialized Scientific Study Center) and by its help - to the Novosibirsk University and research institutes of Siberian Branch of Russia Academy of Sciences(SB RAS) a steady current of gifted young people. The selection of gifted schoolchildren is also carried out by means of Distant Physical and Mathematical School attached to SSSC of NSU.

Every year in April-May the Olympiad Committee of SB RAS sends more than 700 invitations to the Summer School to the pupils that had received recommendations on the base of participating in the Olympiads on physics, mathematics and chemistry and also to the most gifted pupils of the Distant Physical and Mathematical School of all regions of Siberia and Far East.



The Summer School is carried out about from 4<sup>th</sup> to 26<sup>th</sup> of August. On the first two days of Summer School the Olympiads on mathematics, physics and chemistry are carried out. There is an example of such mathematical Olympiads.

**Siberian Olympiad on mathematics.**

1. Can you part all nature numbers for two disjoint sets so that both of them do not consist of any infinite increasing arithmetical progression?

2. A circle  $w_1$  is located inside of another circle  $w_2$ , their centers  $O_1$  and  $O_2$  are different. Some chord of the  $w_2$  is tangent line to  $w_1$  and parallel to the segment  $O_1O_2$ . Its length is equal 6. To find an area of figure consisting of points situated inside of  $w_2$  but outside of  $w_1$ .

3. There are written numbers 1, 3, 4, 6, 8, 9, 11, 12, 16 at a blackboard. Peter has deleted four numbers. And Nick has deleted four numbers. It seems that sum of numbers deleted by Peter was three times more than sum of numbers deleted by Nick. What number could be left at the blackboard?

4. To find all solutions of a system of equations:

$$\begin{cases} x^2 + xy + y^2 = 7 \\ x^2 + xz + z^2 = 21 \\ y^2 + yz + z^2 = 28 \end{cases}$$

5. A triangle  $ABC$  is inscribed into circle,  $AB < AC$ . There is a point  $M$  on the side  $AC$  such that  $AM = AB$ . To prove that a bisector perpendicular of  $MC$  divides in half an arc  $BC$  which does not contain of a point  $A$ .

6. Some pieces of a board  $4 \times 4$  arbitrary are covered by 13 rectangular dominoes  $1 \times 2$ , sides of them are parallel to sides of squares of a board. To prove that one of these dominoes may be took away without opening no one square. Is it true for 12 dominoes?

The Summer School is the second stage of selection in this system (the first stage is a number of district, city, and regional Olympiads). During the Summer School the lessons are carried out and then - control works that demonstrate how the pupils have apprehend the new material. On the base of results of the Summer School the pupils are selected to M. A. Lavrentiev School of Physics and Mathematics of SSSC of NSU.

The Summer School participants demonstrating sufficient abilities for mathematics, physics, chemistry that wish to continue their education in SSSC of NSU are left for deep specialized study.