Report on the scientific and scientific organizational activity of department of the "Algebra and Mathematical Logic" for 2023

About scientific activity

During the reporting period, 4 works combining 7 executives are being conducted on the topics of "Application of methods of algebra and mathematical logic" and "Research of works of medieval Azerbaijani scientists on mathematics and logical sciences".In 2023, 3 articles and 7 theses were published. In addition, 2 articles were accepted for publication.

3 PhDs in mathematics:

1. Babayev Ali A. - head of the department, leading researcher, (full-time)
2. Mammadov Eminagha M. – leading researcher, (full-time)
3. Sheykhzamanova Leyla A. - senior researcher, (full-time)

3 researcher:

4. Majlumbayova Valeriya F. - senior researcher, (full-time).
5. Babayeva Rena G. – researcher (full-time).
6. Aliyev Ali S. - researcher (full-time).
7. Mammadova Vafa M. – junior researcher, (full-time).

1 computer engineer:

8. Karimova Matanat K. – engineer-programmer.

2 laboratory assistants:

9. Hajiyeva Aygun A. - senior laboratory assistant.
10. Shahbazova Sevinj T. - senior laboratory assistant.

Topic 1. "Application of methods of algebra and mathematical logic".

Work 1: Investigating the compactness of weighted endomorphisms in regular algebras whose values are from topological rings.

(Eminaga Mammadov* and *Vafa Mammadova)

The following issue was studied during the reporting period: Let X be a compact Hausdorf space, $C(X)$ Banach algebra of continuous functions with respect to sup norm, and $A = A(X) \subset C(X)$ some uniform algebra, and $C(X, A)$is the algebra given by the norm $\|h\|_{C(X.A)} = \sup_{x \in X} \|h(x)\|_{C(X)}$ of continuous A-valued functions defined on X . $\varphi : X \to X$ is self-mapping of X , $u \in C(X, A)$ is a given function. We look at the weighted composition operator below:

$(Tf)(x) = u(f \circ \varphi)(x),\ f \in C(X, A), u \in M_{A(X)}, \varphi \in C_{A(X)}$.

The set $s(u)=\{x\in X:\exists u^{-1}(x)\}$ is denoted by $s(u)$ In this work, the following is assumed:

$s(u)=\{x:u(x)\neq 0\}$, yəni $\forall x\in X\Rightarrow u(x)=0\vee\exists u^{-1}(x)$

and $\varphi\big|_{s(u)}$ is continius on $s(u)$.

The following main theorem is proved:

Theorem. Let T be a compact operator. Then for any compactly connected component $K\subset s(u)$ and for any peak set E with respect to $A(X)$, we have: either $\varphi(Y)\subseteq E$, or $\varphi(K)\cap E=\varnothing$

The obtained results were prepared as an article under the title "COMPACTNESS OF THE WEIGHTED COMPOSITION OPERATOR" by A.I.Shahbazov, V.M.Mammadova, Z.Panahova. It will be sent to one of the local scientific journals in the near future.

Topic 2. "Research of the works of Medieval Azerbaijani scientists on mathematics and logical sciences".

Work 1: Study of the initial foundations (sources) of the formation of the modern theory of formal logic and proofs based on the works of medieval Azerbaijani logicians.

(***Ali Babayev and Valeriya Majlumbayova)***

Nasireddin Tusi's works "Tajrid al-mantiq", "Esasul-iqtibas", "Euclid's Commentary", Bahmanyar Azerbaijan's "At-tahsil" were studied, and the elements of modern formal logic and the theory of proofs were determined in these works. For example, in his work "At-tahsil", Bahmanyar gave a truth table for "individual" propositions. Truth tables are not found in the works of logicians who lived before Bahmanyar. N. Tusi also gave truth tables for "definite", "indefinite", "modal" propositions in his work "Esasul-Iktibas". In his work "Euclid's Commentary", N. Tusi introduced a number of innovations to the theory of proofs.

Work 2: Examining the consequences of logical figures involving modal premises.

(*Eminaga Mammadov and Rana Babayeva)*

The resulting modes of four logical figures composed of simple syllogisms have been studied in our previous investigations. In this case, figures I and II each have four resulting modes, figure III six, and figure IV five. If modalities are involved in the premises, the resulting modes of these figures differ significantly: the first two figures have eight modes each, and the third and fourth figures have twelve modes each. During the reporting period, the reasons for this difference were investigated and expressed in formal logical language. The results will be prepared and published in the form of a scientific article in the near future.

Work 3: Elements of modern integro-differential calculus in N. Tusin's "Commentary on Archimedes' work "Sphere and Cylinder"".

(Ali Aliyev and Leyla Sheykhzamanova)

The translation and research of Nasireddin Tusi's book "Commentary on Archimedes' "Sphere and Cylinder" from Arabic continues.

4 theorems about the surfaces of a straight cylinder and a cone from the work of Archimedes "N. Tusi's comments on the two-book treatise on the sphere and cylinder".

In the "Theorems" section of the work, N. Tusi comments on the proof of theorem XIII (in Archimedes it is theorem XI). Theorem: If two straight lines are drawn on the [side] surface of a flat cylinder reaching its base, the oval surface left between them is greater than the surface of the parallelogram enclosed by it, left between these two lines.

The next theorem numbered XII by Archimedes is numbered XIV in Tusi's commentaries: If two lines are drawn on the [side] surface of a flat cylinder reaching its seats and lines touching and intersecting the surfaces of the circles of the seats, then the surfaces of the two parallelograms enclosed by the lines tangent to the circle and the two lines on the surface of the cylinder are greater than the sum of the cylindrical surfaces remaining between the two surfaces.

Commenting on the theorem numbered as X in Archimedes' treatise, N. Tusi numbered this theorem as XII. The theorem states: If two straight lines are drawn on the same plane as the surface of the base circle of a straight cone, intersect at a point and are tangent to the circle, then the surface of the two triangles formed by the two tangents drawn to the circle with the straight lines connecting the tangent and the vertices of the cone will be greater than the conical surface they cut from the cone.

In the work "Commentary on the work of Archimedes "Sphere and Cylinder"" information about the calculation of the volumes of spatial figures was studied, their connection with the summation of infinitely decreasing quantities with the modern integro-differential calculus was determined..

About the scientific organizational activity

Head of department Ali Babayev and senior researcher Valeriya Majlumbayova gave a report on " История Математики –наука о прошлом или математическая дисциплина " at the "History of Science and Scientology: Interdisciplinary Studies" International Scientific Conference held in Baku in November 2022.

Head of department Ali Babayev and senior researcher Valeriya Majlumbayova gave a report on " Тезисы Насиреддинна Туси об «определении» в трактате «Извлечение из логики»»”at the International conference "Third Smirnov readings on logic" held on June 22-24, 2023 in Moscow.

At the international conference dedicated to the 100th anniversary of National Leader Heydar Aliyev, 6 employees of the department made a report.

1. Babayev Ali, Majlumbayova Valeriya. N.Tusi about the “Beginning of sciences”

2. Aliyev Ali, Babayeva Rana. Theses on four theorems regarding the surface of a right cylinder and a cone from place N.Tusi's Treatise "Comments on the work of Archimedes" "On the ball and cylinder".
3. Mammadov Eminaga. About special subspaces of Marcinkiewicz and Morrey spaces.
4. Sheykhzamanova Leyla. The theory of additions of the rotational motion of a material point around parallel axes in opposite directions by ancient astronomers.

On October 23-27, 2023, Head of the department Ali Babayev gave a speech on the topic " Роль российских ученых в развитии математики в Азербайджана " at the XLIV International conference dedicated to the 70th anniversary of the St. Petersburg branch of the Institute of History of Science and Technology in St. Petersburg.

The following articles have been accepted for publication:

1. Eminaga M. Mamedov, Natavan P. Nasibova, Sheyma Chetin. "Some remarks on integral operators in Banach function spaces and representation theorems in Banach-Sobolev spaces".

2. E.Mamedov, N.Ismailov. On some structural theorems in Banch function spaces. 11 s.

In addition to these, the second volume of the book "Esasul-Iqtibas" was published under the scientific editorship of the head of the department Ali Babayev.

The leading researcher of the department, Eminagha Mammadov, translated Professor Ivan Anatolyevich Malchev's book "Дискретная математика" from Russian into Azerbaijani. The translation will be fully edited and prepared for printing in the near future.

Vafa Mammadova, a junior researcher of the department, participated as a judge in the Intellectual Competition dedicated to the 100th anniversary of Heydar Aliyev at the Children and Youth Development Center No. 1 on May 3, 2023. Also, Vafa Mammadova successfully completed the 2-semester (23-week) course "Virtual EL Educator: English for Academic Purposes" organized by ANAS and with the support of the US Embassy in Azerbaijan for the purpose of developing the academic writing skills of young researchers in English and awarded with a certificate.