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Contribution of A. Jakštas-Dambrauskas (1860-1938) to Mathematics in Lithuania

Juozas Banionis

Vytautas Magnus University, Lithuanian University of Educational Sciences, Vilnius, Lithuania
Email: juozas.banionis@leu.lt

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Abstract

The article, dedicated to prelate Aleksandras Dambrauskas (pseudonym: Adomas Jakštas, 1860-1938), a Lithuanian encyclopaedist, Honorary Doctor of Mathematics, summarizes the researcher's mathematical works and highlights his merits to the development of the science of mathematics in Lithuania. Most frequently his activities are associated with theology, philosophy, literature and politics. However, it is rarely mentioned that it was actually mathematics which led A. Jakštas' search to be true and beautiful in philosophy, literature and theology. Firstly, he stands out as a reviewer of the fundamentals of geometry and trigonometry in the development of the science of mathematics in Lithuania. The mathematical works that were written by the prelate fall into three groups. The first group includes the original works covering the field of fundamentals of trigonometry and geometry. The second group embraces popularising and informative articles and booklets, and the third group unites school textbooks on mathematics. A. Jakštas manifested himself as a supporter of mathematics. The prelate was interested in problems which could be practically applied in everyday life or were based on all the generally accepted laws of the Universe. The major part of the mathematical works by the prelate was devoted to school mathematics. Observing the dawn of Lithuanian sciences, A. Dambrauskas' significant contribution to mathematics in Lithuania is acknowledged. Reading the mathematical works by the prelate, his ability to fill them with humanist philosophy is admired. A. Dambrauskas is a perfect example for all the mathematicians, and his mathematical works occupy an honourable place in the history of mathematics in Lithuania. This article is dedicated to A. Jakštas-Dambrauskas, an outstanding Lithuanian personality, who left indelible marks in the Lithuanian culture and education. The latter merits are usually enthroned, whereas the prelate's mathematical works are often neglected. In this article, the author returns to the mathematical contribution of A. Dambrauskas, supplementing his presentation delivered in Lithuania in 2011 with new sources, and aims to familiarise readers with this exceptional personality in English. To achieve the established

goal not only already published but also archived materials stored in the Office of the Central State Archive of Lithuania and the Manuscripts Department of Vilnius University Library will be used. The research employs the methods characteristic of research work in humanities: text analysis, interpretation and historical description. Moreover, the criterion of objectivity and the principle of historicism are followed to revive the atmosphere of the end of the 19th century to the beginning of the 20th century.

Keywords

Philosophy, Theology, Fundamentals of Geometry and Trigonometry, Mathematical Terms, Popularisation of Mathematics, History of Mathematics in Lithuania

1. Introduction

The name of Lithuanian encyclopaedist and prelate Aleksandras Dambrauskas (pseudonym: Adomas Jakštas) is most usually associated with theology, philosophy, literature, politics, and, finally, mathematics. However, it is rarely acknowledged that only due to mathematics, the traces of A. Jakštas' search to be true and beautiful extend to philosophy, literature and theology. Firstly, in the evolution of the science of mathematics in Lithuania, he is perceived as a reviewer and "examiner" of the fundamentals of geometry and trigonometry.

The mathematical works of A. Dambrauskas were most widely discussed in the article of Otonas Stanaitis written in the period of Independent Lithuania (Stanaitis, 1938). At the same time Petras Katilius (Katilius, 1938) classified the works of the prelate into three groups and characterised the main ones in general terms. Česlovas Masaitis (Masaitis, 1938) highlighted the philosophical aspect of A. Jakštas' geometry fundamentals and new systems of trigonometry.

A large number of authors of the aforementioned period such as L. Dambrauskas, J. Keliuotis, A. Maceina, P. Samulionis, J. Senkus, S. Šalkauskis, M. Vaitkus, P. Venckus and others presented not only memoir material in their works. They also characterised the prelate as a well-rounded personality, who was committed to church and science. His extraordinary interest in the philosophy of mathematics was emphasised and exceptional liking for mathematics was also revealed on fragmentary basis.

In our times Algirdas Ažubalis and Aleksandras Baltrūnas (Ažubalis, 1990; Baltrūnas, 1996) analysed his main mathematical works. The merits of the prelate to Lithuanian terminology were highlighted by Petras Rumšas (Rumšas, 1979), whereas Nijolė Kalinauskaitė (Kalinauskaitė, 2011) revealed his innovations in development of trigonometric systems.

The article aims to summarize mathematical works of prelate A. Dambrauskas—A. Jakštas particularly emphasising his exceptional merits in enhancing research on the science of mathematics in Lithuania. To achieve the established goal not only published but also archived materials stored in the Office of

the Central State Archive of Lithuania and the Manuscripts Department of Vilnius University Library will be used. The research employs the methods characteristic of research work in humanities: text analysis, interpretation and historical description. Moreover, the criterion of objectivity and the principle of historicism are followed to revive the atmosphere of the end of the 19th century to the beginning of the 20th century.

2. The Road to Mathematics

A. Jakštas chose the following slogan in his life: "to be logical, i.e. to rely on the divine Logos that conducts the world affairs" (Jakštas, 1938: p. 349). Therefore a certain precision-mathematical thinking is felt in all A. Dambrauskas' works from the above-mentioned areas (**Figure 1**).

Even more, employing mathematics he formulated his apologetic arguments. "I particularly liked mathematics in that respect that it employs unvarying, eternal truths; if a human soul is fed with eternal truths, it has to be eternal as well"-A. Dambrauskas wrote" (Keliuotis, 1931: p. 898). While learning in Šiauliai gymnasium (1872), the mathematical abilities of the learner became visible. However, as he confessed himself, his interest in mathematics was rather accidental and conditioned by highly strict character of his mathematics teacher Horbacevičius (Samulionis, 1938: p. 304; Jakšto, A. *fondas*, p. 9). Being in the fifth form, Aleksandras undertook independent studies of theories of geometry. At that time he even managed to demonstrate a "certain" new theorem but later

Figure 1. *A. Dambrauskas-Jakštas* (*1860-1938*).

it turned out that its proof had already been known in the science of mathematics (Senkus, 1938: p. 189). Therefore, possessing an obvious talent for mathematics, A. Dambrauskas chose the Faculty of Mathematics and Nature of Saint Petersburg University in 1880. Such a choice was motivated in the following way: "I chose the Department of Physics-Mathematics because I found the study subjects taught there perfect. I was particularly fascinated by the truths of mathematics. They seemed absolute to me with two divine qualities: presence everywhere and permanence. There is no place without them. What is true in Saint Petersburg is true in Paris, in London, on the Moon and on Mars. In a similar way they are eternal and immutable: they were the same in the very beginning and they will stay the same forever. Thus, I consider it a great honour to serve mathematics. Mathematics has always seemed to me the queen of all sciences". On the other hand, mathematics for A. Jakštas was "an ideal world, where an individual is freest and where he or she is able express oneself best as a creator". Even more, he argued that "If a human creator may remind of God Creator, this is possible only in mathematical creation. The nicest worlds of opportunities are created there namely from nothing" (Maceina, 1938: p. 312-313).

However, disappointment with some university professors as well as riots, which started in his university at that time, forced A. Dambrauskas to change his choice. It is no coincidence that a twenty year old young man, who failed to adapt to life in the capital of empire, wrote to his parent 22 February 1881: "I am just a mere Lithuanian, an individual from bones and blood, who will never be able to learn various customs of the big world or to give up own faith and religion" (Dambrauskas, 1939: p. 250). Therefore, after less than one year of studies in mathematics, he left the university, returned to Lithuania and entered the Samogitian Theological Seminary. There, as the irony of fate may have it, after three years of studies, the archdiocese sent him to Petersburg again and this time-to the Theological Seminary. In 1888 he successfully graduated from the Seminary and was conferred the Master's degree in Theology. Unfortunately, A. Dambrauskas did not have a chance to enjoy the return to Lithuania: after service as a chaplain in Panevėžys gymnasium and occurring disagreements with tsarist officials, he was exiled to Ustyuzhna in Novgorod Governorate (Russia) in 1889. He got acquainted with Lithuanian writer Vincas Pietaris (1850-1902). The latter provided mathematics textbooks and priest A. Dambrauskas' passion for independent mathematical studies arose again and he engaged in the first mathematical research (Samulionis, 1938: p. 307). After five years in exile, he got the right to return to Lithuania in 1894. Staying in Kaunas, A. Dambrauskas spent almost all his life there with exception of the period from 1902 to 1905, when he worked as professor in the Petersburg Theological Seminary and during the first two years of World War I (1914-1915), when he lived in Vilnius.

In 1905 St. Casimir Society, which was committed to publishing books in Lithuanian, was founded. Feeling the lack of scientific knowledge in the Lithuanian language and possessing an inclination for mathematics, A. Dambrauskas undertook writing articles for Lithuanian society and mathematics popularisa-

tion. Under the initiative of the priest, the literary, scientific and political journal "*Draugija*" (Society) was established in 1907. Next to numerous articles on various themes written by A. Jakštas, the journal also published his mathematical texts. After becoming a prelate in 1914, A. Dambrauskas further penetrated into the problems of mathematics ignoring disapproval and contempt of some clergymen. Such efforts did not get unnoticed and 14 December 1928 A. Dambrauskas-Jakštas was conferred the honorary title of Doctor of Mathematics for his merits to Lithuanian mathematics by Faculty of Mathematics and Nature (Lithuanian university in Kaunas) (*VDU MGF fondas.(b), p. 232*).

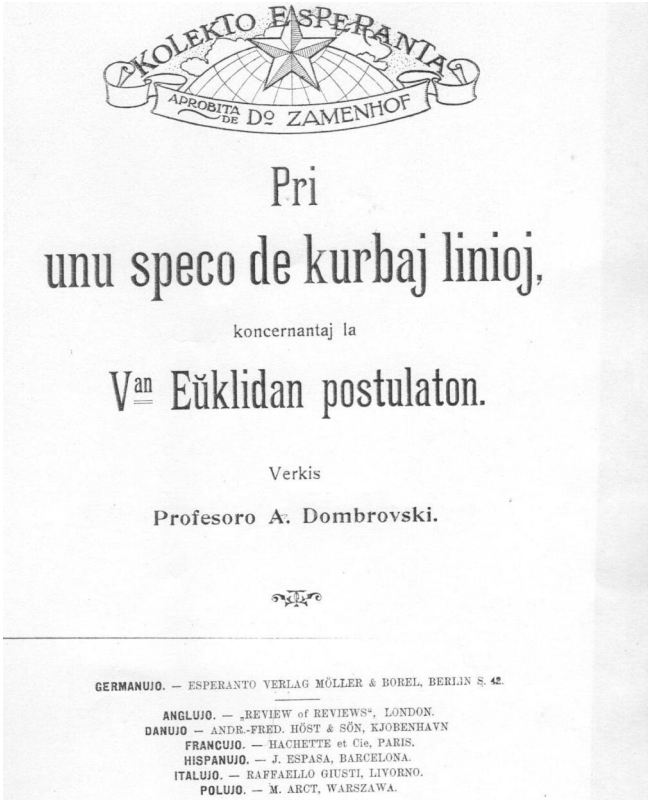
3. Mathematical Works and Their Importance

The mathematical works written by the prelate may be divided into three groups. The first group would include original mathematical works. The second group would comprise popularising and informative articles and booklets, and the third group would embrace school textbooks on mathematics. Each group will be analysed separately.

The first group consists of original mathematical works covering the field of fundamentals of trigonometry and geometry. As early as 1893 and still being in exile in Ustyuzhna, A. Dambrauskas got interested in the problem of parallel lines. He investigated Euclid's Fifth Postulate, which had previously attracted enormous efforts of mathematicians from various epochs, who had tried hard to provide own proofs. Fully emerged into the problem, A. Jakštas introduced a certain curve (conditionally called "*postuloida*"), dependent on Euclid's Postulates, into geometry. The very idea was published in the newspaper "*Wiadomości matematyczne*" (Mathematical News) in 1898. Later corresponding with Prof. Boudier and following Prof. Meray, A. Jakštas continued to improve the aforementioned remarks about Euclid's Fifth Postulate. As a result, the article was written in Esperanto in 1902 and published in the French newspaper "*Revue Bourguignonne*…" (Bourguignonne Review). Moreover, it should be emphasised that A. Jakštas is one of the establishers of Lithuanian Esperanto Association (1919) and a publisher of the newspaper "*Litova stelo*" (Lithuanian Star) published in this international language. The aforementioned article was also published as a brochure in Berlin in 1906 (Dombrowski, 1906: p.14-16) (**Figure 2**).

Finally, having taken into account the recommendations of Prof. O.Voeros, in 1917 the prelate improved his article and published it under the title "Euklido V postulato kreivė ir metageometrijos pagrindų kritika" (The Curve of Euclid's Fifth Postulate and Criticism of Meta-geometry Fundamentals). Its last variant was published in issue three of the journal "*Logos*" in 1926 (Dambrauskas, 1926a). The article consisted of two parts. The first part contained the translation of the article published in Esperanto. It characterised the kinds of new curves (pastulatoids). The second one contained criticism of fundamentals of meta-geometry, i.e., non-Euclidean geometries.

Bearing in mind that "from its very beginning geometry searched for the main concepts for its further creation", A. Jakštas discussed "the perfect straightness"


KOLEKTO ESPERANTA
APROBITA DE Dº ZAMENHOF

Pri
unu speco de kurbaj linioj,
koncernantaj la
Van Eŭklidan postulaton.

Verkis
Profesoro A. Dombrovski.

GERMANUJO. — ESPERANTO VERLAG MÖLLER & BOREL, BERLIN S. 42.
ANGLUJO. — „REVIEW of REVIEWS", LONDON.
DANUJO — ANDR.-FRED. HÖST & SÖN, KJØBENHAVN
FRANCUJO. — HACHETTE et Cie, PARIS.
HISPANUJO. — J. ESPASA, BARCELONA.
ITALUJO. — RAFFAELLO GIUSTI, LIVORNO.
POLUJO. — M. ARCT, WARSZAWA.

Figure 2. About Euclid's fifth postulate in Esperanto, Berlin, 1906.

of the line in the same article. Further, at the end of it the author made the following conclusion "Non-Euclidean geometries cannot be equalled to Euclidian geometry. These are absolutely different branches of geometry: the first one is linear geometry whereas the rest are ascribed to curvilinear geometries" (Dambrauskas, 1926a: p. 281). Thus, assigning priority to Euclidian geometry, A. Jakštas critically assessed fundamentals of other geometries by this article. He endeavoured to find and to draw an explicit distinction between Euclidian and non-Euclidian geometries. The first one was ascribed to the science of mathematics, whereas the remaining ones, following the great Einstein, were thought to belong to branches of science of physics. In fact, these geometries are "purely physical and supplemented by material" (Jakštas, 1931). Meanwhile, the prelate, following his own loyalty to conservatism, believed that he had managed to clear the foundations of geometry from "old paradoxes" and "new sophisms".

Inviting the return to the "true" geometry created by Euclidius, to Euclidian "real lines" and to Euclidian "real planes", A. Jakštas wrote two more works related to the aforementioned problems. One of them, i.e., "*Kas yra tiesioji linija*?" (What is the Straight Line?), was written on the basis the lecture delivered in the recently established University of Lithuania 28 November 1922. Later, after recommendations of Otto T. Volk (1892-1989), a German professor working in Kaunas, the article appeared in volume eight of *Matematikos gamtos fakulteto darbai* (The Works of Faculty of Mathematics and Nature) (Dambrauskas, 1926b). Endeavouring to reveal the essence of the line, A. Dambrauskas

grounded his work on three issues. Firstly he chose Lithuanian literary classicist, bishop Antanas Baranauskas (1835-1902) considerations about the line as a point of departure. Secondly he took into consideration that the definition of the line is the key problem to the whole geometry. Thirdly, in his work he indicated that the problem was not fully solved in mathematics. On the basis of the aforementioned arguments, the author raised the main problem, i.e., searched for the result of infinite prolonging of the line. He found three solutions, which namely meant the geometrical systems of Lobachevsky-Bolyai, Euclidus and Riemann. A. Jakštas also referred to them as to three hypotheses about the line. Having presented a broad historical overview of the line (from Archimedes to C. Vöros), A. Jakštas formulated a conclusion once again emphasising that the true line is the Euclidian one, whereas the other two are non-Euclidian and, therefore, only "quasi-lines". Thus, he undoubtedly prioritised Euclidian geometry over non-Euclidian one and certified own approach towards mathematics full of "certain a priori attitudes arising from intuition or being of metaphysical nature" (Masaitis, 1938: p. 292-293). It is understood that the essence of the analysed problem was predetermined by direct dependence of line and geometries. "Seeking to deeper penetrate into the essence of all the geometries, it is necessary to better cognize the line"-the author stated. Hence, the axioms analysed on the basis of geometry lead to related geometries. Analysing the line he noticed the concept of infinity, which resulted in the emerging paradoxes. Therefore, generalising the work A. Jakštas emphasised that the line itself approximates closer to the object of sciences of philosophy and theology.

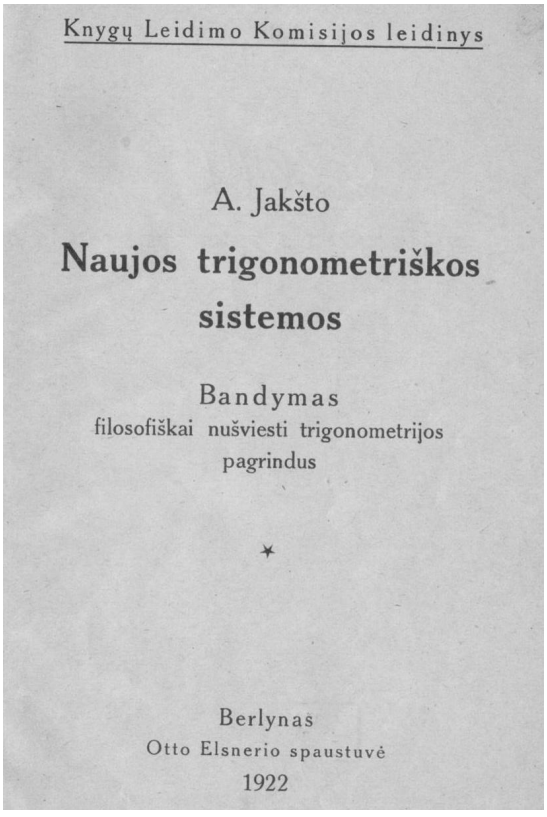
It is necessary to emphasise that the author, who perfectly perceived the problem of the article, succeeded in an elaboration on the essence of reasoning about the concept of line. Further, the words of A. Jakštas at the end of the article should be understood as an encouragement for young people to engage in scientific research: "Thank God, we have already lived to see our university, but it consists not of walls but of people, who are particularly devoted lovers of truth and its diligent seekers" (Dambrauskas, 1926b: p. 391-392). Writing the above-mentioned article, he followed the works by famous mathematicians of that time, such as P. Engriques, E. Isenkrhe, R. Sudre and others.

The second article, which specified the "advantage" of Euclidian geometry, was "*Matematiškos sąlygos kreiviems paviršiams nuo plokščių ir kreivėms nuo tiesiųjų atskirti*" (Mathematical Conditions for Distinguishing Between Curved Surfaces and Between Planes and Curves) (Dambrauskas, 1930). This was as if a supplement to the previously published article "*Kas yra tiesioji linija*?". Following M. Geiger, A. Jakštas pointed out the conditions for compliance of planes and surfaces.

Another original work of mathematics, which is broad in its scope, was written penetrating into trigonometry. In his article A. Dambrauskas considered whether it is the absolute and the sole presently "applied science of triangles". Further he also expressed his opinion that if next to Euclidian geometry system there exist non-Euclidian ones, there should be alternative systems of trigo-

nometry. Own search in that direction was concretised by A. Jakštas in 1902, when he described the first six elementary new trigonometric systems out of twenty eight ones. In the course of time, he succeeded in identifying not only the so-called "elementary" trigonometric systems but also in establishing how to construct a big number of complex ("*sukrautinės*") systems. A. Dambrauskas acknowledged a long-term search for a systemic delivery of a course in trigonometric systems. The article about geometric groups written by professor Bourlet in the French scientific newspaper "*Internacia Scienca Revuo*" (International Science Review) gave a new impetus for such search.

Soon A. Jakštas prepared his article and in October 1905 he sent it to the aforementioned professor Bourlet. The later author approved of the work and in 1906 the article was published as a separate publication in Esperanto in Berlin. Two years later (1908) the article "*Naujos trigonometriškos sistemos*" (New Trigonometric Systems) reached the readers in French, which was translated by professor E. Lefevre from Belgian Military School, who was interested in its theme. A. Jakštas returned to this work once again in 1921, when prepared it for publication in the Lithuanian language. He reorganised the article and added several chapters. In this way, through intermediation of Lithuanian writer, professor Vincas Krėvė-Mickevičius (1882-1954), in 1922 "*Naujos trigonometriškos sistemos*" were published in the Lithuanian language in Berlin. The publication was dedicated to the established Faculty of Mathematics and Nature at the University of Lithuania (Jakštas, 1922) (**Figure 3**).


Knygų Leidimo Komisijos leidinys

A. Jakšto

Naujos trigonometriškos sistemos

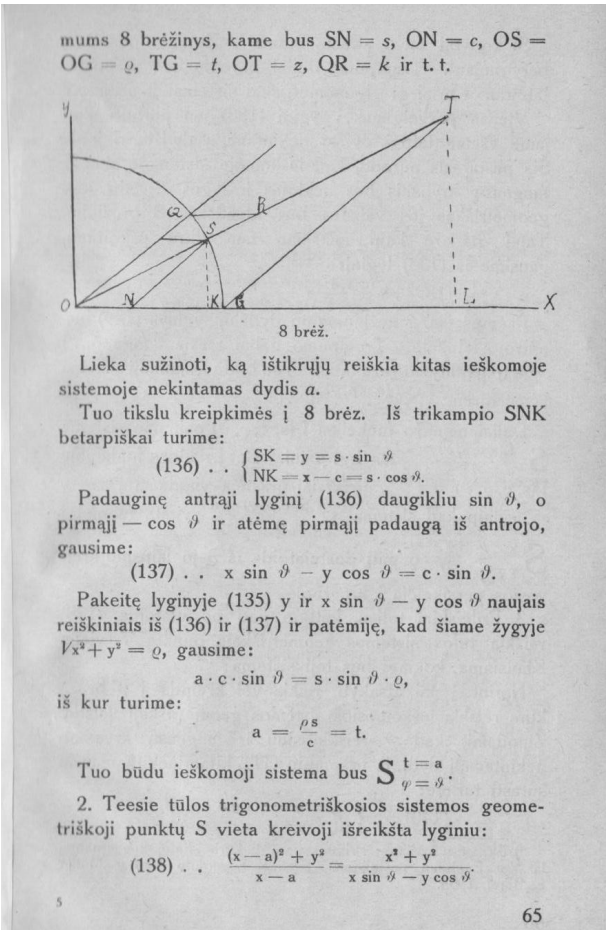
Bandymas
filosofiškai nušviesti trigonometrijos pagrindus

Berlynas
Otto Elsnerio spaustuvė
1922

Figure 3. New trigonometric systems, Berlin, 1922.

In his "*Naujos trigonometriškos sistemos*" the prelate noticed that "the trigonometric system, which is applied at present, is one of the indefinite cases of one more general system" (Jakštas, 1922: p. 71). Taking this into account, the author associated two more variables (a radius and an angle) to the six trigonometric lines already established in the classical trigonometry. Thus, eight values, two of which are regarded as constants, as well as trigonometric functions constructed like in classical trigonometry but differentiating from the ordinary ones, were received. In such a way the aforementioned twenty eight new systems, including the already used one, appeared. They were called elementary. Further, assuming that only one value is considered constant and linking the other values through algebraic equation that corresponds the plane curve, an infinity of trigonometric systems, which the author referred to as "sukrautinės", i.e., complex. Having introduced new trigonometric systems, in the conclusions A. Dambrauskas pointed out that the systems are characterised by functions, which may be geometrically demonstrated in curves. Moreover, a transition from functions of one system to those of other systems is also possible. He provided numerous examples of trigonometric line systems but did not present their complete classification (Kalinauskaitė, 2011: p. 159) (**Figure 4**).

Encouraged by mathematics professor O. T. Volk, the prelate directed his



mums 8 brėžinys, kame bus SN = *s*, ON = *c*, OS = OG = *ϱ*, TG = *t*, OT = *z*, QR = *k* ir t. t.

8 brėž.

Lieka sužinoti, ką ištikrųjų reiškia kitas ieškomoje sistemoje nekintamas dydis *a*.

Tuo tikslu kreipkimės į 8 brėž. Iš trikampio SNK betarpiškai turime:

$$(136)\ \ \begin{cases} SK = y = s \cdot \sin\vartheta \\ NK = x - c = s \cdot \cos\vartheta. \end{cases}$$

Padauginę antrąjį lyginį (136) daugikliu sin ϑ, o pirmąjį — cos ϑ ir atėmę pirmąjį padaugą iš antrojo, gausime:

$$(137)\ \ x \sin\vartheta - y \cos\vartheta = c \cdot \sin\vartheta.$$

Pakeitę lyginyje (135) y ir x sin ϑ — y cos ϑ naujais reiškiniais iš (136) ir (137) ir patėmiję, kad šiame žygyje $\sqrt{x^2+y^2} = \varrho$, gausime:

$$a \cdot c \cdot \sin\vartheta = s \cdot \sin\vartheta \cdot \varrho,$$

iš kur turime:

$$a = \frac{\varrho s}{c} = t.$$

Tuo būdu ieškomoji sistema bus $S_{\varphi=\vartheta}^{t=a}$.

2. Teesie tūlos trigonometriškosios sistemos geometriškoji punktų S vieta kreivoji išreikšta lyginiu:

$$(138)\ \ \frac{(x-a)^2+y^2}{x-a} = \frac{x^2+y^2}{x \sin\vartheta - y \cos\vartheta}.$$

5

65

Figure 4. Fragment of "*New Trigonometric Systems*".

research on systems towards complex rectangular trigonometric systems. In 1926 and 1930 A. Dambrauskas published a two-part study "*Apie sukrautines stačiakampes trigonometrines sistemas*" (On the Complex Rectangular Trigonometric Systems) following the conclusions of the previous work. On the basis of the research on trigonometric functions of oblique triangles conducted by A. Braunmühl and Biehringer, in the first part of his study A. Jakštas introduced characterised curves from the aforementioned systems. In the second part he analysed a reverse problem-any curve described algebraically in the first part requires establishment of the corresponding rectangular trigonometric system. After finishing his study "*Apie sukrautines stačiakampes trigonometrijos sistemas*" and having devoted several years of his life to the problem, A. Dambrauskas made attempts to energise trigonometry and suggested new fields for research in the science of triangles. However, the new trigonometric systems did not find any practical application and were not further investigated.

A. Dambrauskas is the first author, who made attempts to evaluate the merits of bishop A. Baranauskas, as a Lithuanian mathematician. This was the article dedicated to the collection of A. Baranauskas' works prepared by Lithuanian writer Juozapas A. Herbačiauskas (1876-1944) and published in 1906. However, the publication of the book was delayed and the article was published in issue four of the journal "*Draugija*" in 1907. The fact that the author referred to unpublished works (personal letters written by the bishop to him in 1890-1900) increased the significance of that work. They allowed to learn that A. Baranauskas continued his acquaintance with mathematics, which started at school, during the studies in the Academy. There in Petersburg, he adopted knowledge of algebra and also engaged into analysis of the theory of numbers. Having mentioned the works in the area of primes, the prepared dissertation in the theory of numbers, which remained in manuscripts, A. Dambrauskas further discussed geometrical articles written by the bishop that penetrated into the problem of circle quadrature. Evaluating the merits of A. Baranauskas to mathematics in Lithuania, A. Jakštas, wrote that the bishop had not turned "into a mathematician specialist with narrow views. Mathematics was never a goal in itself but only a tool. He trained his own mind with its help. He used the exceptional God-given mathematical talent" (Dambrauskas, 1907).

One more original work of mathematics, assigned to the history of mathematics, was prepared by A. Jakštas on the basis of the lecture delivered accepting the diploma of Honorary Doctor of Mathematics. The lecture was about Polish mathematician and philosopher J.M. Hoene-Wroński and the article titled "A.J.M. Hoenė-Wronski matematikas" (A.J.M. Hoene-Wroński as a Mathematician) appeared in the book "*Užgęsę žiburiai*" (Extinct Lights) in 1930. Here the prelate presented the most important biographic features of the scientist and emphasised his great merits in creation of foundations of algorithmic philosophy. Moreover, A. Jakštas was fascinated by Wronski's search for supreme and most common laws of mathematics and exalted his works in applied mathematics. Feeling the similarity between own attitude and that of the man of science

from Poland, A. Dambrauskas stated: "Mathematics was not the goal in itself and only a means to attain higher goals. Due to this reason, he went towards mathematics following the philosophical path" (Dambrauskas, 1975: p. 401).

The second group of A. Dambrauskas' mathematical works includes the articles that aimed to familiarise Lithuanian society with the achievements in that science. According to mathematician P. Katilius "Mathematics is accessible to the society to the degree the society is educated itself" (Katilius, 1938: p. 148). Assuming this, A. Jakštas undertook dissemination of mathematical knowledge in the society, though popularisation of this science is most challenging.

"*Trys garsieji matematikos klausimai*" (The Three Famous Mathematical Problems) published in 1924 should be firstly distinguished from the mathematical legacy. In the aforementioned work A. Dambrauskas aimed at clarification of three main problems deriving from the ancient times: circle quadrature, doubling of cube and angle trisection (division into three equal parts). These problems only at first sight are clear in terms of their formulation and easily perceivable. However, their solution using a pair of compasses and a ruler was confusing and required thousands of years. The written work was dedicated to the 20th anniversary of the death of bishop A. Baranauskas. The problem of circle quadrature occupies the main place in the article because "this assignment surpasses the other two in terms of its renown and importance" (Jakštas, 1924: p. 5). The essence of the later problem is to draw a square using a pair of compasses and a ruler, whose area is equal to that of the given circle. All the story of solving the problem continued more than four thousand years. The author divided such a long period of time into three parts: "elementary geometry, higher analysis and algebra". Having overviewed each of them, A. Jakštas highlighted the merits of A. Baranauskas ventilating the aforementioned problem. At the end the author acknowledge that he had got "contaminated" by the problem as early as gymnasium and arrived at a conclusion that "arithmetics provides π value, whereas analysis leads to its genesis" (Jakštas, 1924: p. 71).

The second problem had a huge influence on the development of methodology of mathematics and originated from the Delos Island. It is well known that this classical Greek problem asks to draw a cube that is twice as big as the volume of the given cube. The author provided a detailed solution of the problem.

The third objective included angle trisection with the help of a pair of compasses and a ruler. A. Jakštas criticized the works written by some Russian authors (D. Viskovatov, V. Grigorjev and others) on the aforementioned theme. Strictly and theoretically substantiating he analysed the problem and proved that the latter drawings are only approximate. Moreover, the publication also introduced the three best known problems in cases of non-Euclidian geometries. Writing his own work, the author referred to the works by French, German and Hungarian scientists on the related issues. It is important to emphasise that he succeeded in persuading the majority of amateur mathematicians in Lithuania to give up attempts to complete the three well-known ancient problems using a pair of compasses and a ruler.

The latter group also embraces a bunch of less significant science popularisation works. Some of them are related to arithmetic, the science of numbers, for example, "*Apytikris π nubrėžimas*"(Approximate Drawing of π), "*Naujas būdas nuošimčiam surasti apskaitant terminius mokesčius*" (A New Way to Calculate Percentage Keeping Record of Terminated Taxes), "*Apokalipsiškasai skaičius 666 matematikos žvilgsniu ir simboliškoji jo reikšmė*" (Apocalyptical Number 666 from the Perspective of Mathematics and its Symbolical Meaning), "*Šis tas iš humbugo bei hasardo srities*" (Something on Gambling and Ardour), "*Matematiškas vieno gešefto tyrinėjimas*" (Mathematical Analysis of One Business). Some were linked with geometry, such as, "*Bendras būdas taisyklingiems daugiakampiams ratilan įbrėžti*" (A Universal Way of Inscribing a Regular Polygon into a Circle), "*Matematiškas bičių instinktas ir vabalas matematikas*" (Mathematical Instinct of Bees and a Beetle Mathematician), "*Dieviškoji proporcija*" (The Divine Proportion), "*Matematiškas dailės dėsnis*" (Mathematical Law on Fine Arts).

In terms of history of arithmetic there is an interesting article about magic number 666. This work was published as a separate publication and familiarised the reader with the attitudes of Talmud, ancient Greeks and the Bible towards that number. A year later, in his publication of amusing mathematics written in 1921 the author tells about the form of bee comb, grounding the rationale of the choice of hexagon (Jakštas, 1921b). In the second part of the brochure, A. Jakštas referring to "*beržo suklys*" (*Rhynchites betulae*, *"a birch leaf roller"*), called it a beetle mathematician and presented mathematical generalisations of leaf rolling.

In the same year he published a book about the golden ration. In addition, the beginning of this work dates back to 1907, when "*Draugija*" published his article about "mathematical criterion of poetry". Later the article was expanded, showing how the golden ration reveals itself in music, architecture and living nature (Jakštas, 1921a).

Filling in the gap of geometry textbooks, A. Jakštas announced a way to inscribe all the regular polygons into a circle in his "*Švietimo darbas*" (Educational Work) in 1929. The article is particularly significant as it contains explanation how to inscribe septangles, enneagons, tetradecagons and octadecagons (Dambrauskas, 1929).

A few works by A. Dambrauskas, ascribed to that group, remained in manuscripts. They were as follows: "*Vysk. A. Baranausko transcendentalinės progresijos matematiškoji teorija*" (Mathematical Theory of Transcendental Progression of Bishop A. Baranauskas), "*Apie sukrautinio periodiškumo kreives*" (On Curves of Complex Periodicity), "*Keletas žodžių apie menamąjį kintamąjį*" (A Few Words on Apparent Variable) and "*Plokščių ir tiesiųjų linijų tiesumo sąlygos*" (Conditions for Straightness of Planes and Straight Lines). Some of the aforementioned manuscripts were used by the prelate writing other articles (*VDU MGF fondas.(a),* p. 94). A. Jakštas also acted as a critic of works of mathematics. He reviewed several newly published textbooks of mathematics in the journal "*Draugija*". In such a way A. Dambrauskas contributed to publica-

tion one of the first arithmetic textbook by Lithuanian publisher Petras Mikolainis (1868-1934), published in Tilsit in 1909, and recommended it not only for children but also for "adults who do not know the taste of the science".

In the first years of World War I A. Jakštas became a member of Commission for Terminology. He actively involved in coining of Lithuanian mathematical terms. Therefore, later reviews of textbooks of geometry and trigonometry contained numerous corrections of terms. The prelate entered into polemics with Lithuanian educator Pranas Mašiotas (1863-1940) regarding suggested terms of "*galia-laipsnis*" (degree), "*lyginis*-lygtis" (equation), "*logaritmų knygos*-logaritmų lentelės" (logarithmic tables) and others. He argued with mathematics educator Marcelinas Šikšnys (1874-1970) criticising the coined neologisms and suggesting international equivalents: "*diagonalė*-įstrižainė" (diagonal), "*diametras*-skersmuo" (diameter), "*perpendikuliaras*-statmuo" (perpendicular) and others.

Despite the aforementioned contradictions, about 40 mathematical terms coined by A. Jakštas have been acknowledge and used up to now (Rumšas, 1979: p. 55). For example, the following terms were naturalised and have been in use even now: "*atstumas*" (distance), "*aukštis*" (height), "*atitinkamieji kampai*" (corresponding angles), "*brėžinys*" (drawing), "*daugiakampis*" (polygon), "*dvisienis*" (dihedral), "*erdvė*" (space), "*ilgis*" (length), "*išklotinė*" (evolvement), "*įžambinė*" (hypotenuse), "*kūgis*" (cone), "*kampas*" (angle), "*laužtinė*" (broken line), "*matlankis*" (protractor), "*trikampis*" (triangle) and others.

However, a big number of terms suggested by A. Dambrauskas were not naturalised and were replaced by others: "*šonas* (now-kraštinė)" (side), "*ratilas* (skritulys)" (circle), "*ratlankis* (apskritimas)" (compass), "*rutulys* (ritinys)" (sphere), "*stipinas* (spindulys)" (radius), "*skritulys* (rutulys)" (circle) and others.

The prelate was constantly sincerely concerned about terms and even as early 1919 wrote with certain grievances: "There is a trouble with terms: they are coined by anybody and imposed on everybody in a form of immature discoveries" (Jakštas, 1919b: p. 359).

Thus, all the works of mathematics popularisation and information by A. Jakštas were undoubtedly useful to the Lithuanian society. They disseminated new knowledge or supplemented the possessed one of classical mathematics as well as raised the problems addressed in the science and indicated possibilities for their solutions. Moreover, the works increased the interest of young people in mathematics.

A. Dambrauskas wrote two textbooks of mathematics. The Commission of Textbooks under the Lithuanian Scientific Society in 1915 committed a task of writing a geometry textbook to A. Jakštas. To complete the obligation, he chose and translated P. Mironov's "*Parengiamsis geometrijos kursas*" (Preparatory Course of Geometry). The author acknowledged that it was "work of starvation" because unavailability of textbooks necessitated their prompt preparation. However, the prelate was creative and supplemented the Lithuanian material with another chapter on geometry written by I. Yurevich. Moreover, at the end of the book he devised a glossary, where the terms were compared to the terms avail-

able in the geometry book published by Lithuanian public man and engineer Petras Vileišis (1851-1926) in 1900, and provided their equivalents in four languages. It should be pointed out that "*Geometrijos vadovėlis dviklasėms mokykloms*" (Geometry Textbook for Two-Class Schools) was published twice (1916 and 1920) (Jakštas, 1916).

Encouraged by successful results deriving new systems of trigonometry, A. Dambrauskas showed his determination writing an original textbook "*Plokštinės trigonometrijos*" (Plane Trigonometries) in 1919. It was approached by the author as an introduction into the research on trigonometry systems. In addition, it was one of the first textbooks in Lithuanian. Therefore, A. Jakštas seriously studied the works in the related sphere written by foreign authors (F. Bendt, P. Cranz, H. Niewęglowski, A. Davidov, N. Rybkin and others). From the textbooks of the above-mentioned authors he chose "what was good, i.e. what was most appropriate from the perspective of science, methods and pedagogy" (Jakštas, 1920: p. 3). The textbook based on theories and assignments consisted of three parts: "geometry, rectilineal trigonometry and geometrical and analytical expression of trigonometrical functions". Thus, it is necessary to point out that having familiarised with the latest achievements in the science, he made attempts to deliver a course of trigonometry in a modern way.

Following D. Mercier, G. Chelpanov, in 1918 A. Dambrauskas prepared the first Lithuanian textbook "*Logika*" (Logics). A year later the prelate wrote the book "*Logikos evoliucija*" (Evolution of Logics), which is of interest to the science of mathematics. Discussing the object of the aforementioned science, the author in his book singled out two aspects-mathematics of finite and constant numbers and mathematics of infinite and imaginary numbers. Later he explained that "the first one embraces the world of manifestations, which is only a fictitious image of our world. The second one includes the substantial and real world, which means the world the way it is" (Jakštas, 1919a: p. 12). Referring to "real mathematics" A. Jakštas presented a multifaceted understanding of the concept of infinity.

A. Dambrauskas maintained contacts with famous Western European and Russian mathematicians (C. Vöros, E. Lefevre, F. Weinrich, S. Wiekstein, I. Pervushin and others) (A. Jakšto···VUB RS), was an active participant in activities of Mathematics Section of Lithuanian Society of Naturalists. The qualities of specification and criticism were ascribed to him. Consistently following the principle of "classical mathematics", he was also characterised by conservatism. The features of the true scientist were revealed in the personality of A. Dambrauskas. He would refuse to rely on the mathematical truths that he failed to understand himself or to completely clarify, even if they had already been claimed by authorities (Stanaitis, 1938: p. 392).

4. The Role of A. Jakštas in Lithuanian Mathematics (Conclusions)

Acting in the afore-mentioned spheres, A. Jakštas played a role of a supporter

of applied mathematics. Therefore, "he was firstly concerned about specific, down-to-earth problems rather than about a priori transcendental statements" (Žg, 1938: p. 6). The prelate was interested in the tasks, which could be applied in daily life or were grounded on commonly perceived laws of our world.

Jakštas' mathematical works are perceived not only as the very first ones in Lithuanian mathematics. This is confirmed by remembrances of engineer Narutavičius. The mathematics professors from Saint Petersburg University, who would find out about mathematical works of A. Dambrauskas from Lithuanian students, acknowledged them "as deserving attention". Later M. Vaitkus told about it to A. Jakštas and regretted that "he had ignored own vocation" and had not devoted himself fully to mathematics. At that time the prelate answered: "I wish at least one priest had talked to me like this in their time" (Vaitkus, 1938: p. 343).

In fact, according to S. Šalkauskis, A. Jakštas' mathematical works show that he was "a zestful mathematician" (Šalkauskis, 1938: p. 1). A. Jakštas-Dambrauskas relied on the thought: "Hence, theologists and philosophers should see mathematics as a friend and assistant of theology and philosophy rather than an enemy". On the other hand, being aware of the depth of the science of mathematics of those times and critically evaluating the completed work, the prelate, when called a mathematician, would say: "I am not much of a mathematician. I am, perhaps, a lover of mathematics" (Stanaitis, 1938: p. 495). Thus, was A. Jakštas-Dambrauskas a mathematician? According to O. Stanaitis, he should be approached from two perspectives. If introducing the standard that a mathematician is the one, who has had an impact on at least one branch of mathematics, the prelate is considered as an amateur mathematician. On the other hand, if the ability to use mathematical truths was prioritised, A. Jakštas would be definitely qualified as a mathematician. At the same time, it should be pointed out that the bigger number of prelate's mathematical works is dedicated to school mathematics and, this is understandable as he lacks profound knowledge of higher mathematics.

Evaluating A. Jakštas' merits to Lithuanian mathematics, we have to consider the fact that the width of his works in this area was limited by the wide range of his activities. However, it is necessary to emphasise that developing the Lithuanian national education system at the end of the 19th century and establishing the modern Republic of Lithuania after 1918, the discussed works of the prelate undoubtedly disseminated the knowledge of mathematics and evoked interest in the science. The obvious truth was understood that mathematics is "accessible" to the society to the extent the society itself is mathematically educated. It is also significant that publishing his mathematical works, A. Dambrauskas had great hopes to encourage future Lithuanian generations, firstly young people, to penetrate into the science of mathematics and to seek discovery of new truths.

Thus, seeing the dawn of the Lithuanian science, we have to acknowledge undeniable merits of prelate A. Dambrauskas to our mathematics. Reading the mathematical works of the prelate, we admire his ability to transfuse philosophy

of humanism to them. His research works implanted a continuous pursuit of truth seeking in mathematics, denied the existence of the eternal "ignoramus". This makes A. Dambrauskas a model to follow for present and future generations of mathematicians and his mathematical works occupy an honourable place in the history of mathematics in Lithuania.

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