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Samuel Dickstein and his publication on Ignacy Domeyko's master's dissertation (thesis) at University in Vilna

Abstract

Samuel Dickstein founded the journal *Wiadomości Matematyczne* in Warszaw, of which he edited and published 47 volumes in the years 1897–1939. One of them (volume XXV, 1921) presented the scientific work (thesis) of the famous 19th century scholar and teacher – Ignacy Domeyko (1802–1889). It was written in 1822 to obtain a master's degree in philosophy at University of Vilna (Wilno, now Vilnius). The original manuscript of I. Domeyko is has not been preserved.

This report reveals the circumstances and content of the master's dissertation written by I. Domeyko.

Keywords: *history of science in Central and Eastern Europe (Poland, Lithuania), Samuel Dickstein, Ignacy Domeyko, University of Vilna (Wilno, Vilnius), master's thesis, history of differential calculus.*

Samuel Dickstein i jego publikacja o rozprawie magisterskiej Ignacego Domeyki na Uniwersytecie Wileńskim

Abstrakt

Samuel Dickstein założył czasopismo *Wiadomości Matematyczne* w Warszawie, a w latach 1897–1939 redagował i publikował 47 tomów. W jednym z nich (tom XXV, 1921) zaprezentowano pracę naukową (praca magisterska) słynnego XIX wieku uczonego i nauczyciela – Ignacego Domeyko (1802–1889), który został napisany w 1822 roku w celu uzyskania tytułu magistra filozofii na Uniwersytecie w Vilna (Wilno, obecnie Vilnius). Oryginalny rękopis I. Domeyko zniknął.

Artykuł ten ujawnia okoliczności i treść pracy magisterskiej napisanej przez I. Domeyko.

Słowa kluczowe: *historia nauki w Europie Środkowo-Wschodniej (Polska, Litwa), S. Dickstein, I. Domeyko, Uniwersytet w Wilnie (Vilna, Vilnius), praca magisterska, historia rachunku różniczkowego.*

1. Introduction

Following the historical route of mathematics in Lithuania in the 19th century, we come across the name of Ignacy Domeyko (in Lithuanian Ignotas Domeika). He was a graduate of University of Vilna (UV), firmly connected to the science of mathematics. His master's dissertation titled *Jak dotąd tłumaczono zasady rachunku różniczkowego i jak w dzisiejszym stanie matematyki należy je tłumaczyć* (How the principles of differential calculus were hitherto explained and how they should be explained in contemporary mathematics) was successfully defended in 1822 and the Master of Philosophy certificate was obtained. The author, who studied the evolution of mathematics in the 19th century Lithuania and the idea of mathematical manuscripts of that time, both in the Library of the Lithuanian Academy of Sciences and in the Library of Vilnius University, was unable to find the original of I. Domeyko's master's thesis, although other works of his contemporaries have survived and were stored in the manuscript department of the university. Fortunately, in the history of science we have S. Dickstein, thanks to whom we have obtained the work mentioned by I. Domeyko in print.

The work was given great attention one hundred years later when a Polish historian of science Samuel Dickstein took the trouble to publish it in a mathematical journal *Wiadomości matematyczne* (vol. XXV), also as a separate issue[1] (Fig.1).

The work done by Domeyko was described in the book *A thousand years of a mathematical mind in Poland* as a model within the history of mathematics in Poland.[2] Zbigniew Wójcik described the procedure of master's examination and presented the contents of the master's paper in his voluminous monograph about Domeyko published at the end of 20th century.[3] Witold Więsław, looking at the situation of mathematics studies at University of Vilna in the days of Enlightenment or days of Adam Mickiewicz (first half of the 19th century), prepared a book and three articles on this subject. They describe the magisterial process itself, he also presents I. Domeyko master's thesis to a certain degree.[4] Reda Griškaitė recollected the destiny of the master's paper in the review of the monograph by Wójcik mentioned above.[5] It was stated by the author of the paper, who had also performed a historical survey of mathematics in Lithuania before 1832, that the scientific activity of Domeyko started when the master's thesis had been defended[6].

In the Polish historiography S. Dickstein and his activity are widely described, but only a few scientific texts (articles or books) mention the master's thesis of I. Domeyko published by Dickstein.[7] This is important because it is only thanks to S. Dickstein that we can get acquainted with the content of I. Domeyko's first scientific work. This issue had been overlooked by other scholars[8].

This article is expected to contribute not only to the promotion of I. Domeyko's first scientific work, but also to consolidate better the merits of S. Dickstein, raising awareness of the famous citizen-patriot

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[1] Domeyko 1921.

[2] Dianni, Wachułka 1963, p. 174.

[3] Wójcik 1995, pp. 72–73.

[4] Więsław 2002; Więsław 2006; Więsław 2007a; Więsław 2007b.

[5] Griškaitė 2000.

[6] Banionis 2001, p. 48; Banionis 2014, pp. 100–101.

[7] See above footnotes 2 and 4. This Dickstein's finding was noticed also by Duda 1997, p.127.

[8] Domański 2013; Mleczko 2018; Foryś 2019; Lakoma 2019.

of the Grand Duchy of Lithuania, who became a world-famous scientist and the beginning of his path in Vilna / Wilno / Vilnius.

In Lithuania Domeyko's master's thesis has already been analyzed more precisely and there is enough information about it in a collective monograph published at Vilnius University at the 215th anniversary of the birth of I. Domeyko.[9] An attempt will be made in this publication to analyze the document mentioned above both from a historical and a subject-matter point of view, its sources will be shown and the contents and conclusions will be revealed. The subject of the examination in mathematics for the certificate of Master of Philosophy that Domeyko passed will be presented.

Besides the authors mentioned above, the documents from the Manuscript Department of the Library of University of Vilnius (VUB RS) will be relied on (first of all the diaries of examinations within the relevant period).
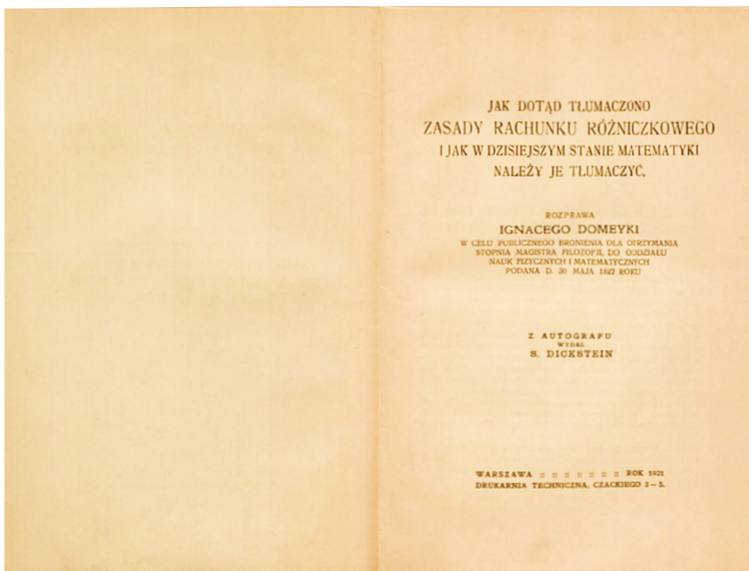

Fig. 1. Title page of Ignacy Domeyko's master's thesis "How the principles of differential calculus were hitherto explained and how they should be explained in contemporary mathematics" Warsaw (1921).

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[9] Domeika 2017, pp. 195–211.

2. A subject of mathematics in the master's examination session

After graduating from the school of Monastic Order of Piarists in Shchuchyn (Szczuczyn, now Belarus) in 1816, Domeyko left for Vilna, where he entered the Faculty of Physics and Mathematics at University of Vilna. He studied for six years: from September 20, 1816 until June 25, 1822. Soon after the beginning of the studies on June 29, 1817 Domeyko was conferred the degree of Candidate of Philosophy, then he studied for the degree of Master of Philosophy (Fig. 2).

The scientific degrees (candidate, master, doctor) in the 19th century were conferred according to the rules accepted in the Russian empire. The sciences at the university were divided into four fields: theology, philosophy, medicine and law. In such case physical-mathematical sciences were ascribed to the field of philosophy. A degree of candidate in fact meant graduation from university and was conferred to a true student who passed the complete course of subjects and was given only excellent marks in the final examination (a mark "excellent" was acceptable only for the examination in one subject). Since then the candidate had a possibility to pursue master's degree. According to the rules, a student was expected to have excellent knowledge of "the complete system of science, its parts and internal relations among them" to be able to explain or to apply it.[10] In order to demonstrate systematic knowledge the students were entitled to examinations in a chosen field, both in the written and oral form. After the examination, only the successful students were given permission to maintain in public scientific work in a chosen field.

Mathematics was rather an important subject at the Faculty of Physics and Mathematics at the time of Domeyko. For example, algebra and higher mathematics were allocated 6 hours per week.[11] The following professors gave lectures in mathematics: Zachariasz Niemczewski (1766–1820) – higher mathematics (until 1820), Michał Pełka-Poliński (1784–1848) – algebra, higher mathematics, Tomasz Życki (1762–1839) – elementary mathematics, algebra, analytical geometry, viceprofessor Anton Wirwicz (1791–1865) – algebra (from 1817).[12]

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[10] Šenavčienė 1991, pp. 46–47; Więsław 2006 , pp. 143–166; Flin, Panko 2015.
[11] Vilniaus universiteto istorija 1977, p. 42
[12] Gečiauskas 1979; Banionis 2001.
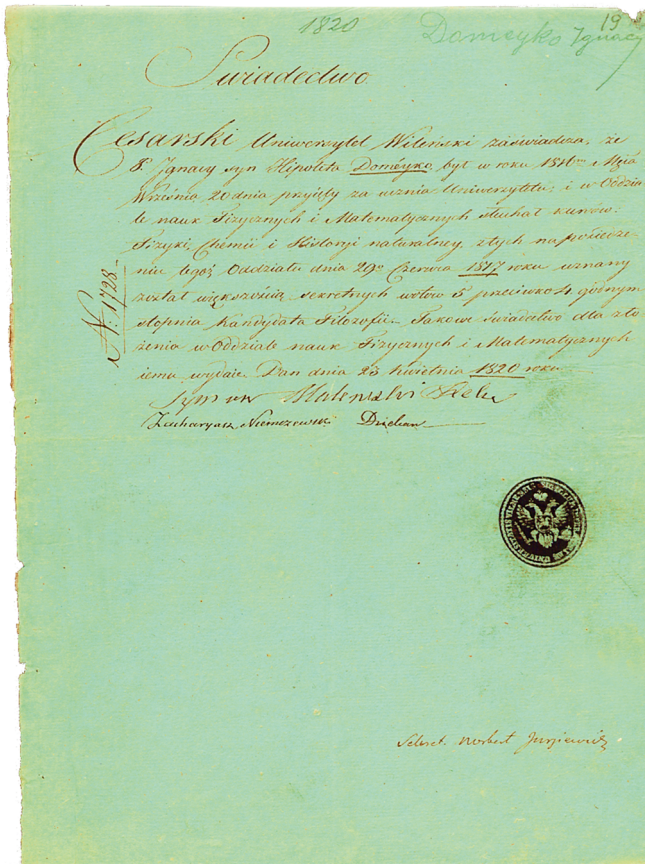
Fig. 2. I. Domeyko's Certificate (Candidate of Philosophy)
(VUB RS F. 2, B. KC114, S. L. 19)

Within the course of mathematics and physics at the faculty there were three main fields: mathematics, physics and chemisty, and natural sciences. Domeyko chose the first field. We can get a notion of his liking of mathematics – all the papers he read during the meetings of Philomaths were on this subject.[13]

The fact that the examination session for the certificate of Master of Philosophy Domeyko passed was very complicated is revealed in the examination diary that was kept at the Manuscript Department

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[13] Wójcik 1995, pp. 74–75.

VUB RS. The examination lasted for two days. On the first day (April 6, 1822) the examination in philosophy took please, as well as in theology, chemistry, physics, architecture and the oral examination in mathematics. On the following day (April 7, 1822), the examination in physics and mechanics were followed by the examination in algebra and analytical geometry (I. Domeyko's Master of Philosophy examination diary).[14] M. Pełka-Poliński, who was the examiner of higher mathematics, asked questions about differential and integral calculus.

The following topics (6 questions) were examples from the first part: to find the maximum and minimum of functions, to indicate relative and absolute cases, to analyze a particular case 0:0, to discuss differential equations of different successions, etc.; from the second part (13 questions): partial integration, application of Bernoulli's formula, integration of differential equation with two variables, integration of linear equations, application of multipliers in an integration.

On the following day, A. Wirwicz conduct the examination in the subject of algebra and analytical geometry. The first subject part of the examination 7 comprised of questions such as: to explain supposed roots, to explain reflex (turnover) lines, to lay out complex fractions to proper fractions, to lay out fractions with equal and non equal, real and supposed multipliers as denominators into proper fractions, to produce an expression of a given arc as sine and cosine of an arc twice smaller, etc. The second subject part of examination 5 included questions such as: curved lines of a second degree – ellipsis, parabola, hyperbola; to itemize an equation of ellipsis, to discuss surfaces, counted in a turn of curved line, etc.

On the same day (April 7, 1822) after the oral part of the examination, the written part took place. Domeyko had to draw two questions for each part of the examination: astronomy and mathematics.[15] The latter part included such questions as: (1) to analyze the equation of ellipsis, also to indicate its flow and the axis of a line, (2) to give the features of common equations, also to explain their progress (Fig. 3).

In the analysis of ellipsis Domeyko produced an expression of a common equation of the curve of the second degree, discussed it in the

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[14] VUB RS, f. 2, b. KC 328, s. lns 89–96.

[15] VUB RS, f. 2, b. KC 328, s. lns 123–129.
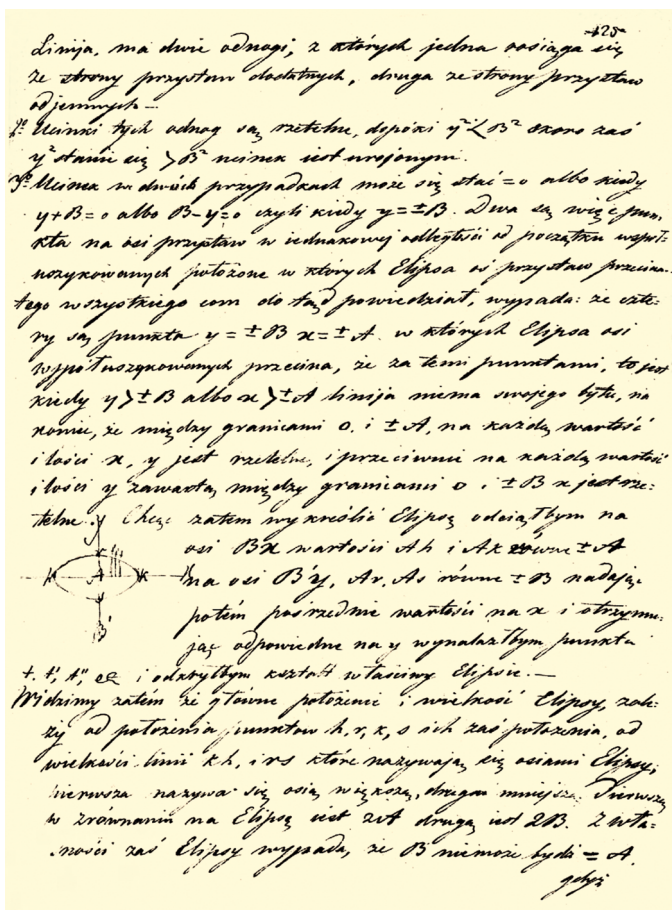
Fig. 3. Fragment of a manuscript of I. Domeyko's examination paper
(VUB RS F. 2, B. KC328, S. L. 125)

case of ellipsis and compared it to the equation of a circle. Regarding the equations, which indicated "a relation between two quantities – known and unknown" equations of the second, the third and the m-th degree were explained and at the end a conclusion of the famous Italian mathematician Paolo Ruffini was quoted "there is no hope to have absolutely similar solutions for the equations higher than the second degree" (I. Domeyko's Master of Philosophy examination diary).[16]

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[16] VUB RS, f. 2, b. KC 328, s. ln. 129.

The examination session was coming to an end on April 7, 1822 chaired by dean T. Życki. With all votes for it was agreed that Domeyko had passed the examination and was permitted to write a scientific work on the subjects "The theory of differential or integral calculus" or "Metaphysics of differential calculus". Domeyko preferred the latter subject and after correcting the tractate a little, he completed it on May 20, 1822. The work was turned into the Faculty and the famous professors of the University of Vilnius read or became acquainted with it: dean T. Życki, Jan Śniadecki, an astronomer and mathematician, Jędrzej Śniadecki, a chemist and physician, Rev. Stanisław Jundziłł (a lecturer of natural history (including mineralogy), then a botanist), Michał Pełka-Poliński, professor of applied mathematics, Józef Twardowski, professor of pure mathematics, adjunct Ignacy Horodecki (a mineralogist and geologist), Karol Podczaszyński, professor of architecture, Kajetan Krassowski, professor of agriculture, viceprofessors Anton Wyrwicz (a lecturer of higher mathematics) and Walerian Górski (a lecturer of theoretical mechanics).[17] The tractate was given a positive evaluation at the meeting of the Faculty on June 5, 1822 and it was defended successfully at the open meeting on June 25, 1822. Domeyko was consequently conferred the degree of Master of Philosophy for his work in the field of mathematics.

3. The Master's thesis on the metaphysics of differential calculus

As it is definitely known, the original dissertation for the degree of Master of Philosophy consisted of 26 pages.[18] Since the manuscript is now lost, we have to rely on the book *How the principles of differential calculus were hitherto explained and how they should be explained in contemporary mathematics* published in the 20th century (Fig. 1). Two parts made the contents of the work: a historical one and general conclusions. A description of the rise and development of differential calculus was given (from the 17th century until the beginning of 19th century), the essence and the use of the theory, which was new when it was described (Fig. 4).

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[17] Wójcik 1995, p. 73.
[18] Ibidem.

Treść pisma.
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I. CZĘŚĆ HISTORYCZNA.

1. Uwagi wstępne.
2. Źródła, z których powstały zasady Rachunku różniczkowego i które służą do ich wyjaśnienia.
3. Metod infinitezymalny L e i b n i z a.
4. Metod płynności N e w t o n a.
5. Metod granic N e w t o n a.
6. Metod L a n d e n a.
7. Teorja E u l e r a.
8. Sposób wyprowadzenia zasad, podany przez P. L h u i l i e r a.
9. Teorja p. d'A l e m b e r t.
10. Teorja funkcyj analitycznych P. de la L a g r a n g e.

II. WYPROWADZENIE OGÓLNYCH WNIOSKÓW.

1. Wszystkie metody redukują się do trzech główniejszych.
2. Uwagi nad pierwszym.
3. Uwagi nad drugim i porównanie go z poprzednim.
4. Uwagi nad trzecim i porównanie z poprzednim.
5. Nieprzyzwoitości metodu P. de la G r a n g e.
6. Zaradzenie tym nieprzyzwoitościom.
7. Uzupełnienie metodu nieskończoności.
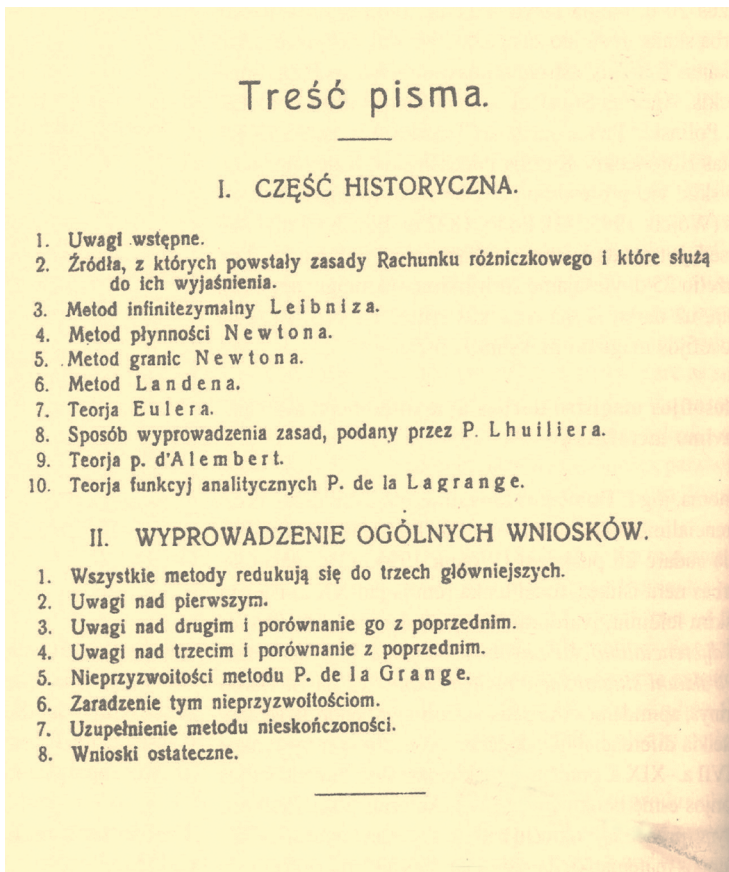8. Wnioski ostateczne.

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Fig. 4. The contents of I. Domeyko's Master's thesis

The author quoted widely the original works of European mathematicians in Latin, French and German that had been published in Leipzig in *Acta Eruditorum* (1684, 1689, 1712) or as separate issues. In this journal some works on differential calculus by Gottfried W. Leibnitz were published in 1712. Among other quotations were: *De geometria indivisibilibus* (1635) by Bonaventura F. Cavalieri, *Methodus fluxionum* (*Method of fluxions*) (1736, 1744) and *Philosophiae naturalis principia mathematica* (*Mathematical principles of natural philosophy*) (1739) by Isaak Newton, *Untersuchung über den eigentlichen Sinn der höheren Analysis* (1808) by Ernst G. Fischer, *Réflexions sur la métaphysique du calcul infinitésimal* (1813) by Lazare N.M. Carnot, *Leçons de calcul differentiel* (1814) by Jean G. Garnier,

Théorie des fonctions analytiques (1813) by Joseph L. Lagrange and *Traité du calcul differentiel et du calcul integral* (1819) by Sylvestre F. Lacroix. All the books had already been classics or the authors were famous for their mathematical textbooks.

I. HISTORICAL PART
1. Preface.
2. The sources from which the principles of differential calculus emerged, and which serve the explanation thereof.
3. The infinitesimal method by Leibnitz.
4. The method of fluxions by Newton.
5. The method of limits by Newton.
6. The method of Landen.
7. The theory of Euler.
8. The ways to derive principles, provided by L'Huilier.
9. The theory of d'Alembert.
10. The theory of analytical functions of Lagrange.

II. MAIN CONCLUSIONS
1. All methods are reduced to the main three.
2. Remarks to the first method.
3. Remarks to the second method and its comparison to the previous method.
4. Analysis of the third method and its comparison to the previous methods.
5. The defects of the method of Lagrange.
6. The result of the defects.
7. Improvements to the infinitesimal method.
8. Final conclusions.

The first part of the paper, which was more voluminous and titled as a historical part, consisted of an introduction to the development of differential calculus. Domeyko noted that the sources of the theory reached even the Antics: already Euclid, Apollonius, Archimedes applied the exhaustion method in their works about the constant approach of a polygon towards a curved line.

B. Cavalieri made a direct impulse to differential calculus in the first part of the 17th century. He introduced into geometry indivisible parts of continuous quantities and their sum for the figures of planes. However, there were some difficulties in applying Cavalieri's method, which

was based on the division of a figure into parallel lines and their sum. Domeyko mentioned Pierre de Fermat, Blaise Pascal and Gilles P. de Roberval, who developed the theory towards the direction, mentioned above, then stopped at the name of René Descartes. Domeyko concluded that R. Descartes, who suggested the theory of infinite quantities, was approaching the infinitesimal method. This method introduced the rules of differentiation. According to the theory of G. Leibnitz, "a polygon is used as a curved line", but it may result in some mistakes, as "the number of polygon sides is not taken into account".[19] Therefore the author draws our attention to the fact that when a bigger number of polygon sides is chosen then a more precise result is achieved. G. Leibnitz talked about the problem of infinite quantities, which later was investigated by other mathematicians. I. Newton explained it with the help of the method of fluxions. Having compared methods of Leibnitz and Newton, Domeyko noticed that the latter discussed a curved line as a limit of a polygon with an increasing number of sides. I. Newton discussed sides of a polygon not as segments, but as a certain quantity within a motion, connected by fluxions via x, y-axes, where the dot moved in a curve (bow) along a fluent. In such a case the aims of the method include an imagination of a motion and the motion itself, from the point of view of time[20].

Brook Taylor and Colin MacLaurin developed fluxions of higher succession suggested by I. Newton later. Domeyko stressed the fact that it was I. Newton who introduced the concept of motion in mathematics. But the method of fluxions in mechanics caused some disagreements, as the smallest quantities were rejected. In that case I. Newton developed and suggested the first and the last relation method, i.e. the limit method. Domeyko analyzed it and indicated the similarity between the methods suggested by I. Newton and G. Leibnitz. The Englishman John Landen could be called "a connecting link" between the mathematical ideas of the British Isles and Europe. He suggested an algebraic substantiation for the analysis and his own method for the differential calculus. Leonhard Euler worked on the theory suggested by G. Leibnitz and introduced a theory that successfully conferred "the smallest quantities the status of zero" as the difference

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[19] Domeyko 1921, p. 11.
[20] Domeyko 1921, p. 13.

in differential calculus is made not by the smallest quantities but by the relations among them. As Domeyko noted, in other cases the analysis may become "a calculus of zeroes", and it will make no sense at all.[21] The problems of differential calculus were still solved at the end of the 18th century. Simon A. J. L'Huilier was famous in this field when he suggested an analysis method, similar to J. Landen's, though he came to a case of indetermination when the meaning of members of a differential equation was explained not only in geometry, but also in mechanics. Meanwhile Jean B. D'Alembert developed a theory that took him back to the limits of relations and supplemented Newtonian science. This theory united the mathematical ideas in the continent of Europe and Britain.

As the author concluded, J. Lagrange was the one who made the greatest progress in differential calculus at the beginning of the 19th century. Domeyko explained the theory of exposing the functions of one, two, three, etc. variables and introduced alternations with the application of fluxions of the functions of the first, second and third successions. Consequently, J. Lagrange formulated the fundamental principle of differential calculus:

> discovering the relationship between the functions of different orders, means, in any case, discovering derivatives of various orders from a given primary function.[22]

If a theory of functions is introduced in differential calculus, its application in geometry and mechanics could be examined. With the support of geometrical interpretation a theory of curved lines is deduced, which – if related to mechanics – gives expressions of straight or accelerated motion.

The methods, discussed above, use the theory of an exhaustion method – such was Domeyko's conclusion referring to the French mathematician L. Carnot. This idea started the second part of the work – the general conclusions. At first, Domeyko stressed that "all the methods could be reduced to three main methods": the infinitesimal quantities,

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[21] Domeyko 1921, p. 20.
[22] Domeyko 1921, p. 25: „wynalezienie związku, zachodzącego między funkcjami różnych porządków, czyli wynalezienie w każdym razie, z danej funkcji pierwotnej funkcyj pochodnych rozmaitego porządku".

the limits and the analytical functions.[23] Following L. Carnot, the author described the vanishing quantities method and compared the patterns of G. Leibnitz and L. Euler. In the former case the infinitely small but real quantities were analyzed, in the latter – zeroes were taken, so the choice of differential coefficients became a problem.[24] Having analyzed the limit method, i.e. the second method, Domeyko indicated the idea of J. D'Alembert to find and compare one size of two limits. But such a method put a strain on the calculus through approaches of differentiation in geometry and mechanics.[25]

Within the third method a derivative of functions was analyzed instead of limits. The method was considered to be pure algebraic, as it passed on to lines, and from lines to derivative functions. Though Lagrange's method was considered to be the best of the methods discussed, it showed some defects when compared to the algorithm of Leibnitz (it becomes complicated when applied to the functions of several variables, undetermined relations among differentials).[26] The above set limits for the method in mechanics. To avoid the complications Domeyko suggested including the algorithm of G. Leibnitz into the theory of functions, according to the works of S. F. Lacroix and J. G. Garnier.[27]

In suggestions to improve the infinity method Domeyko referred to the German mathematician E. G. Fischer and showed the meaning of differentials in geometry, i.e. how they developed during the analysis of a geometrical figure. For example, a spatial figure (parallelepiped or pyramid) was taken and a differential was applied to calculate it. The analysis was illustrated with a graphical picture (Fig. 5).

At the end of his scientific work Domeyko made a final conclusion: the method of Lagrange was the best to describe the essence of a differential within the theory of differential calculus. The theory of infinity, suggested by G. Leibnitz, could be introduced into this method. Altogether a study of metaphysics of a differential calculus gave an idea how far we still were from a true theory.

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[23] Domeyko 1921, p. 33.
[24] Domeyko 1921, p. 36.
[25] Domeyko 1921, p. 37.
[26] Domeyko 1921, p. 39.
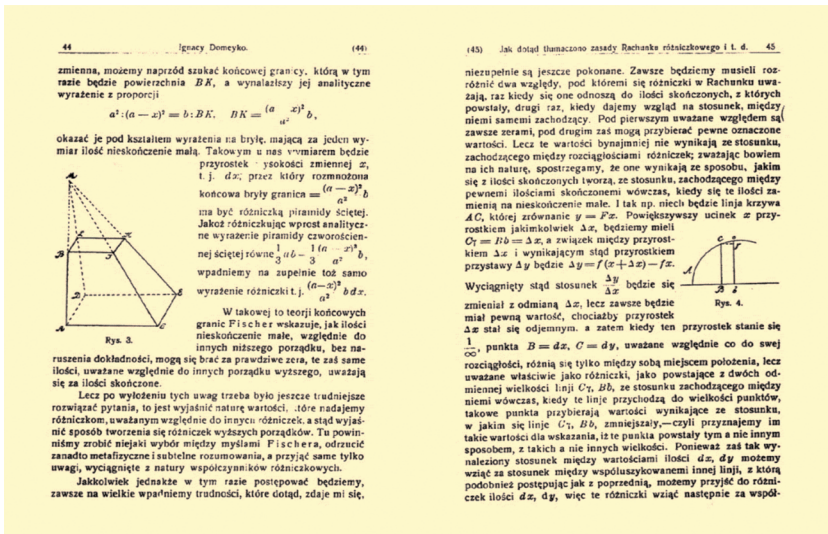[27] Domeyko 1921, p. 41.

Fig. 5. The fragment of I. Domeyko's work

An assertion could be made, based on a thorough study of Domeyko's scientific paper for his master's degree: the author described the development and history of differential calculus in the 19th century, analyzed thoroughly the ideas of the most famous mathematicians of England, Italy, France and Germany, defined their meaning in high mathematics and their use in geometry and mechanics.

4. Conclusions

A scientific paper for his master's degree by Ignacy Domeyko entitled *Jak dotąd tłumaczono zasady rachunku różniczkowego i jak w dzisiejszym stanie matematyki należy je tłumaczyć* (How the principles of a differential calculus were hitherto explained and how they should be explained in contemporary mathematics) can help to get an image of the differential calculus theory and the possibilities of its application in the first quarter of the 19th century, not only in Vilna, but throughout the Russian Empire, to which Lithuania then belonged. Thanks to Samuel Dickstein's efforts, I. Domeyko's Master's thesis was published in 1921 in Warsaw and became more widely known.

Domeyko demonstrated deep knowledge and high mathematical culture when he answered questions on the subject of algebra, analytical

geometry, differential and integral calculus during the examination of mathematics on April 6–7, 1822.

The Master's dissertation on the metaphysics of differential calculus was defended on June 27, 1822. Profound knowledge of the theory and practice on the subject that Domeyko demonstrated could be reinforced with the following facts: the author referred to and quoted works (articles, papers, textbooks) of famous mathematicians of England, Italy, France and Germany; different methods of differential calculus were discussed together along with a historical background and the main principles of the subject; the use of differential calculus was showed, examples in geometry and mechanics were given. Domeyko's master's thesis shows that mathematics in Vilnius was developed in contact with the European mathematics of the early 19th century.

The investigation of metaphysics of differential calculus made by Domeyko had a direct influence on his scientific career. Though he did not deviate from the path of mathematics, the scientific work skills acquired in Vilna had to be useful to him in the fields of other sciences: geology, mineralogy, mining, meteorology, natural history, and higher education in Chile.[28]

5. Acknowledgements

Bibliography

ARCHIVAL MATERIALS

VUB RS (Manuscript Department of the Library of the University of Vilnius): f. 2, b. KC 328; f. 2, b. KC114.

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[28] For his achievements in these branches of knowledge, he became a foreign member of the Academy of Arts and Sciences in Kraków in 1873.

PUBLISHED MATERIALS

Alma Mater Vilnensis 2012: *Alma Mater Vilnensis. Vilniaus universiteto istorijos bruožai.* (Highlights of Vilnius university history). Vilnius: Vilniaus universiteto leidykla, 1056 pp.

Banionis, Juozas 2001: *Matematinė mintis Lietuvoje (istorinė apžvalga iki 1832 m.*, (Mathematical thought in Lithuania. Historical overview unitil 1832). Vilnius: VPU leidykla, 68 pp. Available online: http://talpykla.elaba.lt/elaba-fedora/objects/elaba:4295851/datastreams/MAIN/content.

Banionis, Juozas 2002: Ignoto Domeikos magistro mokslinio darbo istorinė ir dalykinė analizė. / *Ignotas Domeika 1802–1889. Gyvenimas, darbai ir indėlis į mokslą* (Ignacy Domeyko 1802–1889. His life, works and contribution to science) / edit. A. Grigelis. Vilnius: Geologijos ir geografijos institutas, pp. 117–126.

Banionis, Juozas 2014: *Matematinės minties raida Lietuvoje. Nuo matematikos žinijos atsiradimo iki matematikos mokslo įsitvirtinimo. (*The evolution of mathematical thought in Lithuania. The emergence of knowledge of mathematics to the Sciences of Mathematics qualifications). Vilnius: Lietuvos edukologijos universiteto leidykla, 324 pp.

Bieliński, Józef 1890: Stan nauk matematyczno-fizycznych za czasów Wszechnicy Wileńskiej. Szkic bibliograficzny. *Prace Matematyczno*-Fizyczne, pp. 265–432. Available online: http://matwbn-old.icm.edu.pl/ksiazki/pmf/pmf2/pmf2116.pdf.

Dianni, Jadwiga; Wachułka, Adam 1963: *Tysiąc lat polskiej myśli matematycznej.* Warszawa: Państwowe Zakłady Wydawnictw Szkolnych, 285 pp.

Domeika, Ignotas 2017: *Ignotas Domeika: geologas, mineralogas, kalnų inžinierius* (Ignacy Domeyko: geologist, mineralogist, mining engineer) / Vilniaus universitetas, Lietuvos Ignoto Domeikos draugija / edit. A.Grigelis. Vilnius: Vilniaus universiteto leidykla, 725 pp.

Domeyko, Ignacy 1921: *Jak dotąd tłumaczono zasady rachunku różniczkowego i jak w dzisiejszym stanie matematyki należy je tłumaczyć* / wyd. S. Dickstein. Warszawa, 47 pp. Available online: https://jbc.bj.uj.edu.pl/dlibra/doccontent?id=253424.

Domański, Czesław 2013; Samuel Dickstein (1851–1939). *Acta Universitatis Lodziensis Folia Oeconomica* 285, 2013, p.11–13. Available online: http://dspace.uni.lodz.pl:8080/xmlui/bitstream/handle/11089/10035/01-doma%c5%84ski.pdf?sequence=1&isAllowed=y.

Duda, Roman 1997: Stulecie Wiadomości Matematycznych. *Wiadomości Matematyczne* XXXIII, pp. 111–135. Available online: https://wydawnictwa.ptm.org.pl/index.php/wiadomosci-matematyczne/article/download/4678/4252.

Flin, Piotr; Panko, Elena 2015. Stopnie naukowe w carskiej Rosji. *Prace Komisji Historii Nauki PAU* XIV, pp. 269–272. Available online: http://pau.krakow.

pl/PKHN-PAU/pkhnpau-XIV-2015-10.pdf. DOI 10.4467/23921749PKHN_ PAU.16.010.5266.

Foryś, Urszula 2019: Początki Warszawskiej Szkoły Matematycznej. Available online (21.11.2019): http://www.deltami.edu.pl/temat/roznosci/historia_i_filozofia/2019/08/27/Poczatki_Warszawskiej_Szkoly_Mat/.

Gečiauskas, Evaldas (Гячаускас, Э.) 1979: Математика в Вильнюсскм университете до 1832 г. (Mathematics at Vilnius University until 1832) *Lietuvos matematikos rinkinys* XIX, pp. 5–12.

Griškaitė, Reda 2000: Zbigniew Wójcik. Ignacy Domeyko: Litwa. Francja. Chile. Warszawa–Wrocław, 1995. *Lietuvos istorijos metraštis*, 1999 metai, Vilnius, pp. 284–285. [Review].

Lakoma, Ewa 2019: Samuel Dickstein. Available online: https://www.icmihistory.unito.it/portrait/dickstein.php.

Mleczko, Paweł 2018: Samuel Dickstein the Founder of Wiadomości Matematyczne. *Wiadomości Matematyczne* 48(2), pp. 331–334. Available online: https://wydawnictwa.ptm.org.pl/index.php/wiadomosci-matematyczne/article/view/342/346.

Ryn, Zdzisław Jan 2002: *Ignacy Domeyko: Obywatel świata*. Kraków: Uniwersytet Jagielloński, 691 pp.

Šenavičienė, Ieva 1991: Moksliniai laipsniai Vilniaus universiteto fizikos-matematikos mokslų fakultete 1803–1832 m. *Lituanistika* 4(8), pp. 43–57.

Vilniaus universiteto istorija, 1977: *Vilniaus universiteto istorija*. (History of Vilnius University). 1803–1940, t. 2, Vilnius: Mokslas, 344 pp.

Więsław, Witold 2002: Matematyka wileńska za czasów Adama Mickiewicza. *Wiadomości matematyczne* XXXVIII, pp. 139–177.

Więsław, Witold 2006: Matematyka wileńska za czasów Adama Mickiewicza. Archiwalia. *Wiadomości matematyczne* XLII, pp. 143–166.

Więsław, Witold 2007a: Prace magisterskie z matematyki na Uniwersytecie Wileńskim w XIX wieku. *Kwartalnik Historii Nauki i Techniki* 52(3–4), pp. 241–262. Available online: http://bazhum.muzhp.pl/media//files/Kwartalnik_Historii_Nauki_i_Techniki/Kwartalnik_Historii_Nauki_i_Techniki-r2007-t-52-n3_4/Kwartalnik_Historii_Nauki_i_Techniki-r2007-t52-n3_4-s241-263/Kwartalnik_Historii_Nauki_i_Techniki-r2007-t52-n3_4-s241-263.pdf.

Więsław, Witold 2007b: *Matematyka polska epoki Oświecenia*. Warszawa: Fraszka Edukacyjna, 359 pp.

Wójcik, Zbigniew1995: *Ignacy Domeiko. Litwa, Francja, Chile*. Warzawa-Wrocław: Polskie Towarzystwo Ludoznawcze, Seria wydawnicza "Biblioteka Zesłańca", Stowarzyszenie "Wspólnota Polska", 477 pp.