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Short Communications Abstracts

Section 20

History of Mathematics

Menelaus' Theorem from Būzajānī and Abū Nasr Irāq to Tūsī

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Iranian scholars, in Islamic era, came to be acquainted with Menelaus' Theorem, as the fifth theorem of Menelaus' *Sphaerica*, via 1) translation of Ptolemy's *Almagest* in which Menelaus' Theorem appeared as the basis of theorems and proofs, and 2) translation of Menelaus' *Sphaerica* itself.

Afterwards, several corrections, elaborations, and explanations of these two books appeared in Islamic world [1] and [5]. The scholars of fields such as mathematics, astronomy, and philosophy paid special attention to Menelaus' Theorem because of its important role in astronomy [2], [3] and [4].

So, Menelaus' Theorem came to be the subject matter of some important books and treatises under the title "*ashshakl ol qattā*" [\"secant figure"\"*figura alkata*"], in its plane and spherical forms [1], [2] and [4].

Understanding the development of Menelaus' Theorem from Abū Nasr Irāq and Būzajānī to Tūsī has important lessons for those who are interested in the history of mathematics. This paper, therefore, will trace the subject in original works to show its development in three aspects as follows:

1. It came to make use of "sine"s instead of "chord"s;
2. It came to find some new proofs;
3. It came to find the form of "Sine Theorem" for the first time in the history of mathematics under the title "*ashshakl ol moghnī*" [\"*figura moghni*"="supplier of needs figure" or "the figure which makes superfluous"] or "*alqānūn ol hey`a*" [\"astronomical law"\"*regula astrologia*"].

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Trigonometric series from 1855 to 1876

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1855 is, of course, the date of Riemann's Habilitation thesis, while 1876 is the year of du Bois-Reymond's proof that there are continuous functions whose Fourier series do not converge everywhere. Meanwhile influential papers such as Cantor's 'Uber die Ausdehnung eines Satzes aus der Theorie der trigonometrischen Reihen' appeared. This paper contains not only the definition of a derived set but also hints at transfinite ordinal numbers. In the talk I will outline the work that was taking place at this time and show the mutual influences of the authors.

The role of the association of mathematics french teachers in the creation of the research institutes in mathematics (I.R.E.M.) in France in 1969. 1955–1975: Modern mathematics and the major transformations of mathematics education in highschools curriculaes

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1. French Association of Mathematics (A.P.M.E.P.) since 1910

   - Composed of highschool teachers only until 1945. Yet, had but a real influence in the modernisation of the mathematics vocabulary.

   - After 1945, it opened to University teachers and gained a national and international recognition.

2. Two outstanding men: Gilbert Walusinski and Guy Brousseau

   - Gilbert Walusinski's presidence of the APMEP from 1955 to 1958.

   - Conferences on modern mathematics organised by the APMEP and the French Mathematical Society (SMF) introduced important modifications in curriculaes and pedagogical methods.

   - Didactics of mathematics by Guy Brousseau. The experimental school and the creation of I.R.E.M. in Bordeaux in 1969.

3. 1966-1969: The politic action of the APMEP. Edgar Faure, Minister of education, created I.R.E.M.

   - Gilbert Walusinski's influence on the APMEP.

   - The Lichnerowicz ministerial commission.

   - Guy Brousseau and his experiments of new methods at school.

   - The training of teachers in modern mathematics.

4. Curriculaes of modern mathematics in 1971

   - Programms of eleven-years old pupils.

   - Problems encountered by 14-years old pupils and teachers.

   - Geometry disappeared at highschool. (Euclid must go, by Jean Dieudonné in 1959).

5. Some reasons of accounting for the advent of modern mathematics

   - Felix Klein's Erlangen programm. Geometry becomes a chapter of projective geometry.

   - Hilbert's formalism: A new thinking of the use of axioms was been employed.

   - The impact of modern algebra and Bourbaki's revolution in secondary curriculaes.

Newton and linear regression analysis

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Manuscripts from the Jewish National and University Library in Jerusalem known as Yahuda MS 24 suggest opportunities, first, to claim Newton's priority as the inventor of a certain linear regression technique and, second, to analyze with a modern regression technique an astronomical table of unknown origin in one of Newton's manuscripts.

Yahuda MS 24 A-D contains Newton's proposal for new civil and ecclesiastical calendars [1]. Along the way, Newton had attempted to compute the length of the tropical year using the ancient equinox observations reported by Hipparchus of Rhodes. Though Newton had a very thin sample of data, he obtained a tropical year only a few seconds longer than the correct length. The reason lies in Newton's application of a linear regression technique, a competitor to the modern *ordinary least squares* (OLS) method [1]. Newton also showed a clear understanding of *qualitative* variables [3].

Yahuda MS 24 E contains a draft entitled *Rules for the Determination of Easter* that sheds new light on Newton's "years of silence," which fall between his work on the nature of light (1675) and the theory of gravitation (1684) [4]. The draft contains an astronomical table with the solar and lunar positions for the years 30-37 AD, which Newton used to decide on the date of the Passion of Christ. The OLS regression method, applied to the table's lunar data, strongly suggests its pre-Tychonic origin [5]. A direct statistical analysis shows that the table has little correlation with astronomical data coming from Ptolemy, al-Battani, Tycho Brahe, Johannes Kepler, Philip van Lansbergen, Thomas Streete, John Flamsteed, or Newton's own 1702 lunar theory; however, its lunar positions display very strong correlations with the *Prutenic* tables based on Copernicus' De Revolutionibus [2].

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The genealogy project at 100,000

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We discuss the origins of the project and the growth over the last decade. In our quest to be truly international we now have over 100,000 mathematicians from more that 100 nations and 1200 degree granting institutions. The significance of the project to the international mathematical community and our understanding of our intellectual heritage will be explored. Information regarding how world wide participation can be increased will be promulgated.

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Numerical examples in manuscripts of Euclid's *Elements*

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Several Arabic manuscripts of Euclid's *Elements* include numerical examples in their diagrams. Such examples most often appear in book V and in books VII-IX, although examples from books II, VI, and X are known. Numerical examples, some using Arabic symbols, also appear in several Greek Euclidean manuscripts. Examples also occur in diagrams in some Latin manuscripts, although written in Western symbols. (For examples, see [1].) Because these symbols are not part of the original text, they have been ignored by editors or students of textual transmission [2]. They are now studied for the first time.

Such numerals are inserted into the diagrams after the original text diagram is produced. Once added, they became part of the text and were transmitted with the text. In a case of direct copying, the Arabic original (Chester Beatty 3035) was given numerical examples and these examples were reproduced in the copy (Tehran, Majlis 200). It is not yet known whether insertion of such examples was limited geographically or temporally. The existence of numerical examples in manuscripts from both sides of the Greek-Arabic and Arabic-Latin linguistic frontiers suggests a possible tradition of numerical examples. Preliminary studies, however, reveal little continuity across linguistic boundaries.

The purpose of numerical examples is not yet understood. Do they reflect a pedagogical convention? reveal readers trained in arithmetic and/or algebra attempting to understand Euclidean mathematics by converting its abstract principles into numerical expressions? indicate a relationship between the practical study of surveying and the abstract science of geometry?

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1931: a Spanish book on summability by Julio Rey Pastor

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The general contribution of Rey Pastor (Logroño 1888 - Buenos Aires 1962) to the summability of divergent series and integrals has been considered in [1], where the role of the book [2] was emphasized. In the VIIIth Congress of the Spanish Society of History of Sciences and Techniques (Logroño, Spain, 2002), the authors of this short communication announced (see the proceedings paper [3]) a project of annotated edition of [2] who was finished in 2005 and is now in press (available when the ICM). Our contribution is focused in the evolution of Rey Pastor' work on analysis in Spain and Argentine before 1931, and in some relevant aspects of [2], from the historical point of view, arisen during the process of the critical edition.

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Filiations and ruptures with the redundancy in the mathematics and the computer sciences

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Properties exist in the well formalized theories; these they are: consistency, independence and complexness. Some historical references are made to the evolution and importance that have or not the absence of the second property, so that, the existence of redundancy in the scientific thought and in the practice of the Mathematics and the Computer Science.

Castelnuovo, Enriques and the influence of Klein on Italian mathematics teaching

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It is well known that Felix Klein always combined advanced research with a strong interest in organisational and didactic problems relating to the teaching of mathematics at both secondary and advanced levels. The methodological assumptions which underpin Klein's conception of education and its aims can be deduced from his writings and his activities as president of the International Commission on Mathematical Instruction. They can be roughly summarised as follows. Firstly, he desired to bridge the gap between teaching at university and secondary education. Secondly, he sought to promote the application of mathematics to natural sciences. He also suggested introducing the concepts of function and transformation at an early stage, and to dedicate more classroom time to the mathematics of approximation (*Approximationsmathematik*), that is, 'the precise mathematics of approximate relations'. Moreover, he believed that teachers should capture the student's interest by presenting the subject in an intuitive manner and, if possible, in the context of its historical development. Finally, he was absolutely convinced that elementary mathematics seen from a higher point of view should have a key role in teacher training.

Klein's ideas on education were particularly appreciated by the Italian algebraic geometry scholars, such as Segre, Fano, Gino Loria, Guido Castelnuovo, Federigo Enriques and Francesco Severi. This consonance of thought was surely enhanced by the considerable affinity in their methodological approach to scientific research. In my talk I will focus my attention on Castelnuovo and Enriques, seeking to identify:

1) their reasons for choosing to occupy themselves with problems relating to maths teaching;

2) the epistemological vision of mathematics by which they were inspired;

3) the various ways in which their commitment to the field expressed itself;

4) the influence of Klein.

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Iranian cryptography in the middle ages

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Less direct references can be found about Iranian cryptography in old centuries, some indirect researches eliminates the structure of Iranian cryptography in the old centuries, in this paper we classify this kind of cryptography to three classes, including the governmental ,public and industrial cryptography according to the inference of the examples which can be found in the famous literature poems or the historical people like kings, ministers or writers which were appeared in the famous books, our basic concentration in this work is on a cryptized works of Iranian famous scientist called Sheykh Bahayi who lived in Isfahan in 16th century and has left many magical works like moving tower, reflexive tomb, interesting bridges and an exciting cryptized poems with equal number of characters which gives a special message about a desired subject in business, economy, journey and more than twenty other interesting subjects, having public and private keys, there are 18*12*30 possible ways of choosing a character at first step as a private key and then by applying a special algorithm which is explained completely, the message will be determined by having the key, some examples are given to clarify the results, finally other kind of Iranian cryptography are also explained. Following table is an example for two hundred sixteen different messages as a harmonic poem form.

7	1	1	200	80	1	40	600	2	20	20	20	70	70	90	600	2	300
4	200	4	200	2	400	10	100	8	40	200	4	2	10	600	400	5	5
1	400	80	5	900	6	30	20	1	1	6	200	7	2	2	10	1	300
90	4	1	1	70	70	300	20	1	1	400	1	2	50	70	70	4	1
4	200	7	20	40	70	4	600	100	100	1	1	6	1	3	2	5	10
10	200	400	400	2	2	20	400	40	50	5	7	600	10	2	2	100	100
200	1	2	4000	40	7	200	20	400	2	400	400	1	6	50	4	4	10
90	4	10	10	1	20	400	10	300	200	2	6	6	50	600	60	20	50
70	5	6	10	300	10	4	20	200	50	200	6	6	300	50	11	5	
1	4	40	20	6	400	1	200	200	4	2	5000	70	200	50	100	400	60
2	1	60	60	10	4000	80	4000	1	6	600	50	100	10	1	6	60	40
400	200	400	400	200	6	400	200	400	400	200	6	10	1	60	60	10	20

(1)

Alternatives to descriptive geometry - history of a French geometrical technique in England

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History of Descriptive Geometry in France and its utilisation in the French educational system since the 18th century, has already been well documented in the work of Taton (1951), and more recently Sakarovitch (1989, 1995). The history of the technique in England, however, makes a captivating story, particularly as it relates not only to the technique itself, or how the treatises relating to it were translated into English, but because it was also closely related to the establishment of the architectural and engineering professions in Britain.

I will trace the history of Descriptive Geometry from its translation into English at the beginning of the 19th century to the end of that century and show that it did find a place in the educational system of English architects, engineers and even mathematicians, but in a modified form. I will also show how descriptive geometry developed in Britain during the 19th century and how textbooks were written on the technique, to be used in some newly established universities. I will examine the differences between the original system of Descriptive Geometry, and the modified, anglicized version of the technique.

Relationships which were built on the basis of likes and dislikes of the technique, and collaborations that ensued between British and French scientists/mathematicians of the times will be also one of the main aspects of this talk.

Cite references in the normal manner: [1], [2] and [3]. But please do not introduce section commands or define any macros.

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At the origins of functional analysis: Peano and Gramegna on ordinary differential equations

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In the context of the theory of infinite matrices and linear spaces, two articles by Giuseppe Peano (1858–1932) and by his student Maria Gramegna (1887–1915) on differential systems have interesting implications for the reconstruction of research in functional analysis in the period of transition from the matrix approach to the operator-theoretic viewpoint. The techniques of geometric calculus, along with the method of successive approximations, led Peano to a rigorous proof of existence for the solution of linear differential systems. Gramegna proved the extension of Peano's theorem to systems of infinite linear differential equations and to integro-differential equations. Gramegna was inspired by the papers of Volterra, Fredholm and Hilbert, but her work was equally influenced by the approach based on abstract spaces and distributive calculus developed in Italy by Peano and Pincherle. Therefore her article provides an interesting example in order to fill the "vacuum in the theory of linear spaces in the years from 1900 (or 1888) to about 1920" [[3] 133–134]. I'll try to evaluate the historical value of Peano and Gramegna's contributions, linked to the logic approach of the Peano's *Formulario Mathematico*, providing an analysis of their treatment and surmising the modernity of the analytic tools, the influence and the international reception of their works. I'll also stress the negative consequences that Gramegna's note had on Peano's lectureship in Higher Analysis at the University of Turin, leading to his dismissal, which marked the beginning of the progressive decline of his school.

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Mathematician Vojislav G. Avakumović (1910–1990)

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Serbian mathematician Vojislav G. Avakumović (Zemun (Serbia) 1910 - Marburg a.d. Lahn (Germany) 1990) published his first treatise on a mathematical subject at age 25 - in 1935, and his last in 1956 - when he was 46. His total output came to 39 publications; at least five of which were presented in outstanding monographs and took their rightful place in the history of mathematics (G. Doetch, *Handbuch der Laplace-Transformation I-III*, (Birhäuser, Basel, 1950), E. Seneta, *Regularly varying functions*, (Springer Verlag, 1976), N.H. Binhgam, C.M. Goldie, J.L. Teugels, *Regular Variation*, (Cambridge University Press 1987), H.H. Ostmann, *Additive Zahlentheorie II*, (Springer Verlag, 1956), E. C. Titchmarsh, *Eigenfunction expansions, Part II* (Oxford, 1958)). All his treatises, except two dealing with differential geometry, belong to the field of classical analysis, or more precisely, to Tauberian theorems in the complex domain, to asymptotics of solutions of differential equations, and, in particular, to the spectral theory of Laplace operators applied to elliptic partial differential equations. The glow of Avakumović's results does not pale with the passing of time. Starting from the works of eminent mathematicians - Karamata, Hardy, Littlewood, Weyl, Carleman - Avakumović, without fail, chose the currently topical and difficult problems. Along the way, he endeavoured to give to each of his results a final form, that is to say, to start from the most general assumptions and then prove theorems which, as a rule, cannot be improved upon. Thus Avakumović's works introduced essentially novel ideas and procedures, and proved fertile soil for further exploration.

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Harmonic analysis in the history of science and technology

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The role that harmonic analysis had in the development of fields of mathematics like integration theory, partial differential equations, number theory, functional analysis and numerical analysis are known to mathematicians [1]. Maybe less known is the role that this theory has had in the development of sciences like acoustics, signal theory, optics, computerized tomography, nuclear magnetic resonance, crystallography. This role will be the theme of the talk [2].

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Historical notes upon the origin of the probability argument

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The notion of probability raises broad philosophical discussions. The different views: classical, frequentist, subjective, Bayesian, logicist, axiomatic, address the nature of the indeterminism. The various schools argue about the essence of the probability that they discuss as a monolithic idea and normally overcome a "component" of the probability concept that is the variable of the probability. Researchers on the historical antecedents of the probability calculus can but share a similar style when they illustrate the evolution of the probabilistic notion through the centuries. The present contribution addresses a different direction since it focuses on the *probability argument*, which one can see as the object of the probabilistic measurement. It may be said these pages share an "analytical" style because they treat a part of the probability concept. Mathematicians tell the entity A is the argument of the probability $P = P(A)$, where A denotes the chances in gambling, a random event or a physical quantity, the outcome or a variable etc. The unique mathematical model of A has not yet definitively established due to its complex contents thus the present paper investigates the birth and the evolution of the argument of probability. This work is in line with the history of the indeterministic thinking published in Appendix in [1].

Authors agree that the roots of the probability, and in consequence the roots of the probability argument date back to Pascal. The Parisian scientist wrote a letter to Le Pailleur Academy in 1654 that revealed the emergence of the novel mathematical realm, which was the probability calculus [2]. This awareness and the methods of calculus introduced by Pascal gained the universal reputation as the founder of the probability calculus for the Parisian mathematician. The idea that the probability argument A is a point may be found in the same letter addressed to Le Pailleur even if Pascal does not express his conjecture in a formal manner. In the years ahead, eminent authors such as Christian Huyghens, Jakob Bernoulli, Abraham de Moivre undertook matters basically related to gambling and confirmed the argument of the probability, namely the chance to win, is a point on the theoretical plane. The Pascal conjecture became clearer in Laplace's work who grounded the idea of probability upon the number of possible results and the favorable ones. The simple Pascalian conception of the probability argument was definitively sanctioned in Kolmogorov's theory who assumed the random event is the set A in the space of cases $\mathfrak{I}$ [3].

In the first decades of the twentieth century the relationships between the probabilistic calculus and the physical reality have been amply elaborated. The discussion led to irreconcilable interpretations of the probability that may be related to the theoretical model of A. It may be said that frequentist and subjectivist establish two different assumptions for the probability argument. The former holds that the probability refers to all the occurrences of the event. The set A has countless elements, and von Mises coins the concept of 'collective' to embrace all of them. Conversely subjectivists (and Bayesians) focus on the single event [4]. They deal with only one occurrence of the event namely the set A has only one element.

The present study aims at enlightening the Pascal conjecture from the historical perspective, and underlines the role played by the probability argument in the divergences raised amongst the various schools of thought.

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Nature in Newton's philosophy of mathematics

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Isaac Newton's (1642–1727) contibution to the quatitative sciences in the history of science is well-known. However, not much has been documented concerning his perspective of nature in his philosophy of mathematics. In this paper, the author will examine Newton's view based on some of his writings, particularly his *Philosophiae naturalis principia mathematica* in light of contemporary theories of nature.

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The factors of the mathematical studies in the enslaved Greece and Ottoman Empire (1453–1821)

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During the Ottoman rule the training in the Academies of the enslaved Hellenism and in the Ottoman military schools, served various goals set by the Hellenic community and the Ottoman Empire to satisfy the particular needs of the two societies: Greek and Muslim. Through the educational process Mathematics, served the goals of both societies.

As the Greek merchants understood the considerable contribution of Mathematics to the successful exercise of the art of trade, they chose to support as they could the instruction and the diffuse of Mathematics to the schools of the occupied Hellenic regions. The development of trade, and consequently the economic bloom of Hellenism, brought about the intellectual and cultural evolution of the regenerated ethnicity and the modernization of the Hellenic society.

The instruction of Mathematics in the Ottoman military schools was enforced by the state, and was mostly dictated by the needs of the Ottoman Empire, which sought well trained officers to modernize the armed forces. It was imperative for the ottoman students of the military schools to learn Mathematics, in order to be able to assimilate the technology of the Western countries military accomplishments.

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Geometry in the ancient babylon. a possible interpretation of tablet YBC 8633

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At the moment, we don't have any mathematical document from the Old Babylonian Period in which the height of a trapezoidal figure appears calculated. In that time, the surface of a quadrangular field used to be determined by applying the surveyor's rule: multiplying the average of its opposite sides.

Obviously, for those people it would be very complicated to find the height of an irregular trapezoid; but if they already knew the Pythagorean formula and the questioned figure was an isosceles trapezium, why this principle was not employed?

In this communication we will show, only as a conjecture, that at least there is a geometric exercise in which the students would learn how to compute the surface of a symmetric trapezium, beginning with the calculation of its true height. This would be the problem text YBC 8633.

Seemingly in this exercise the area of a symmetric triangle - divided in three regions - is determined; nevertheless, although the calculation introduces the rule of the diagonal, the obtained result is erroneous. It is very surprising! We will prove here that it is only a routine carried out in the determination of surfaces of symmetric trapezoidal fields.

We will connect our analysis with the last studies carried out by Jöran Friberg on the Egyptian geometry.

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