Paulus Gerdes & Ahmed Djebbar

MATHEMATICS IN AFRICAN HISTORY AND CULTURES:
AN ANNOTATED BIBLIOGRAPHY

African Mathematical Union
Commission on the History of Mathematics in Africa
(AMUCHMA)
Mathematics in African History and Cultures


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Cover design inspired by a pattern on a mat woven in the 19th century by a Yombe woman from the Lower Congo area (Cf. GER-04b, p. 96).
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Preface

One cannot but welcome this very important annotated bibliography on *Mathematics in African History and Culture*. We are already at the beginning of the third millennium and, yet, one is often struck by attitudes, largely based on ignorance, towards the mathematical contributions from Africa and by Africans. I am sure that it is this phenomenon and the collective experience and knowledge of Gerdes and Djebbar that have led to the conceptualisation of this publication. It is, indeed, long overdue. This publication informs us about both the history of mathematics in Africa and the mathematics in the history of Africa. It is also appropriate that the contributions of Africans outside Africa, or as is commonly referred to, the African Diaspora, are included. For, often the involvement and impact of Africans on life and developments outside Africa, especially in developed countries, are knowingly and unknowingly underplayed or even ignored.
Mathematics in African History and Culture: An Annotated Bibliography, is bound to have a major impact on the curricula of courses on (the history of) mathematics in Africa. The role of African mathematicians in astronomy, time-reckoning and calendars can now be researched and appreciated more fully. By including the mathematics in African culture, the authors have attached meaningful value to the systematic, analytical and structured nature of African cultures. Thus string figure and board games emerge as meaningful mathematical activities in addition to being enjoyed as forms of relaxation. As far as it is known, this bibliography, of over a thousand references, is not just the most comprehensive ever produced, but also covers the whole African continent over many centuries as well as recognising “the historical links across the Mediterranean and the oceans”. This latter aspect is important because it puts the achievements in so-called western mathematics into perspective.

I believe that there is a need for African students and researchers, especially the younger generation, to realise that Africans have made meaningful contributions to science and mathematics. This realisation should serve as inspiration to them. The technological and economic development of Africa in this modern age depends on various applications of mathematical sciences. Getting to grips with what has been produced by our forebears is potentially important for the generation of new knowledge, particularly in this era of knowledge-based economies.

On behalf of the African Mathematical Union, I sincerely wish to thank Professors Paulus Gerdes and Ahmed Djebar for their contribution. They are, indeed, two stalwarts in our quest for unearthing and highlighting contributions by Africans to mathematical research and teaching.

Jan Persens, Ph.D
President of the African Mathematical Union (2000-2004)
Bellville, South Africa
June 2004
Introduction

One of the first measures taken by the Executive Committee of African Mathematical Union (AMU), elected at the 2nd Pan-African Congress of Mathematicians (April 1986, Jos, Nigeria), under the chairmanship of Professor Aderemi Kuku, was to create an AMU Commission on the History of Mathematics in Africa (AMUCHMA). The two authors were appointed chairman and secretary. At the subsequent congresses in 1991 (Nairobi, Kenya), in 1995 (Ifran, Morocco) and 2000 (Cape Town, South Africa), the authors were re-elected. As co-ordinators of the commission, we have tried to stimulate research, and to collect and disseminate as much information as possible about the history of mathematics in Africa. Along with the many papers delivered at conferences and seminars organised during the years, we published so far 28 issues of the AMUCHMA Newsletter. To the delegates of the 6th Pan-African Congress of Mathematicians (September 2004, Tunis, Tunisia), we would like to present the following bibliography on mathematics in African history and cultures.
The bibliography contains over one thousand five hundred references. It is the result both of the information we collected in the context of AMUCHMA and of our personal research. The first author used also the information he gathered as secretary (1991-1995) of the Southern Africa Mathematical Sciences Association (SAMSA) for the *Who is Who in Mathematics and Mathematics Education in Southern Africa* (5-GER-92, 93, 95).

Our bibliography attempts to encompass the African continent as a whole, from immortal times to the present, without forgetting the historical links across the Mediterranean and the oceans. For instance, several references included in the bibliography highlight the circulation of mathematicians and of mathematical ideas between the Maghreb (Northwest Africa) and Andalusia (Iberian Peninsula) during the ‘Middle Ages.’

The present bibliography is as embracing, complete and update as was possible. Mainly references in Arabic, French, English, Portuguese, official languages of the continent, were selected. For studies from and about the mathematicians of Alexandria (Egypt) we tried to include the most relevant references from 1980 onwards. Partial bibliographies on Africa South of the Sahara and the Maghreb were published earlier in the *AMUCHMA Newsletter* (GER-92b, 92d; DJE-95a, 95b), in the international journal *Historia Mathematica* (GER-94f) and in the Spanish journal for the history of science and technology *LLULL* (GER-04e).

**Organisation of the bibliography**

Bibliographic references directly referring to mathematical ideas in African history and cultures are included in the main body of the bibliography. Several appendices present complementary bibliographies on themes related to the main theme. For instance, as several entries in the main body refer to mathematicians of African descent, Appendix 1 presents additional bibliographic information on mathematicians of the Diaspora. As during history African mathematicians were often involved in astronomy, Appendix 3 presents an additional bibliography on time-reckoning, calendars and astronomy in African cultures. As several authors discuss the use of string figure games in mathematics education, Appendix 4 presents an
additional bibliography on string figures in Africa. As various studies referred to in the main body analyse mathematical ideas of players of African board games, Appendix 6 presents an additional bibliography on board games in Africa.

To complete the image of what research is done by African scholars in the field of the history of mathematics, Appendix 2 lists publications of African scholars on the history of mathematics outside Africa. This research may be related, for instance, to mathematics in Islamic or Arab cultures or to the application of research methodologies developed in Africa to other cultural contexts, like the analysis of mathematical ideas of basket weavers in the Amazon.

As instances of AMUCHMA projects to be continued, Appendix 5 presents examples of books and booklets published by African mathematicians. Appendix 7 lists some examples of African mathematical pioneers in the 20th century. Appendix 8 presents an example of a mathematical research field inspired by the historical study of ‘sona’ ideograms from Angola.

To try to make the bibliography as useful as possible, several indexes have been included, making it possible to retrieve information by subject, country, region, ethnic or linguistic group, author, journal and mathematician.

**Bibliographic entries**

The references are as complete as possible as we were able to collect. The entries in the bibliography are presented in alphabetic order of the authors. The bibliographic information comes in the following sequence: year of publication, author’s surname, author’s first name(s), co-authors or co-editors, title (in original language), translated title, publisher or journal, place and country of publication, volume, issue, page numbers or total number of pages.

A bibliographic reference is followed by a brief annotation describing the contents of the publication. No annotation means either that the title of the reference presents already a reasonable description of its contents or that we were so far not able to see ourselves the publication. An annotation between “…” means a quotation from the author or editor. We welcome any complementary information.
Invitation

If a bibliographic reference is given incompletely, it means that we have not been able to establish the complete reference, and any reader that has the missing information is invited to send it to us. Similarly we extend this invitation to any reader who knows of references that are missing in the bibliography, or is able to present additional information about the contents of a book or article in the bibliography.

Reference codes

Each entry is referred to in the indexes by a code composed of the first letters of the surname of the (first) author followed by the last two digits of the year of publication, like AUT-04. If more than one publication of the same author appears in the bibliography, a letter is added to indicate its place in the order of publications: AUT-04a, AUT-04b, etc.

A reference in one of the appendices is coded like 3-AUT-04, indicating that it appears in the third appendix.

The bibliography we present to the 6th Pan-African Congress of Mathematicians is a first attempt, and as such necessarily incomplete. We hope it may be updated regularly, and that it may become available in various languages, and in several forms (book, CD, web). We hope to include in update further an overview of mathematics in African history and cultures and further appendices, in particular, an appendix on the development of mathematics in Egypt from the Middle Ages to the 19th century.

Acknowledgements

We should like to thank wholeheartedly all members of AMUCHMA and colleagues who gave us information over the years. In particular, we should like to thank those colleagues who in the final stage of the preparation verified or complemented some of the entries:
We should finally like to thank the successive presidents of the African Mathematical Union, Professors Aderemi Kuku (1986-1995, Nigeria), Mohamed Kerkour (1995-2000, Morocco) and Jan Persens (2000-2004, South Africa) for their encouragement of the activities of AMUCHMA.

Paulus Gerdes & Ahmed Djebbar

June 2004
Introduction to the new edition

The reactions to the first edition of this bibliography have been very positive and encouraging. For instance, the African Studies Association attributed it a ‘special mention’ in the 2006 Conover-Porter Award competition.

In the second edition 170 new entries are introduced. Appendix 7 about mathematical pioneers in the 20th century has been withdrawn, as this theme is analysed in detail in the book *African Doctorates in Mathematics: A catalogue* (GER-07). By consequence, Appendix 8 of the first edition becomes the new Appendix 7. The catalogue of doctorates includes also a list of over 300 doctorates in mathematics education, of which only a few are referred to in the present bibliography as examples.

Illustrations are included in the new edition. They may give an image of some mathematical ideas in African history and cultures.

Paulus Gerdes & Ahmed Djebbar

March 2007
Bibliography

A

AAB-64

Chapter 2 is on Euclid’s construction of the regular pentagon (35-72) and chapter 4 on Ptolemy’s construction of a trigonometric table (101-127).
Translation: AAB-84.

AAB-84
Translation of: AAB-64.
Informs about the recent discovery in Marrakech (Morocco) of the first book of *Kitâb al-kâmil* (Complete Treatise on the Art of Number), a manual written by Abû Bakr (or: Abû Zakariyâ’) al-Hassâr (12th century, Maghreb). This treatise together with the little book *Kitâb al-bayân wa t-tadhkâr* of the same author played an important role in mathematics education in the Maghreb from the 12th century until the beginnings of the 16th century. Probably they constitute the oldest written proofs of mathematical activity in this region of North Africa.

ABA-87


See ABA-86.

ABA-88


This thesis includes a critical edition (based on 8 manuscripts), a translation into French and an analysis of the most important mathematical treatise of the Maghrebian scientist Ibn al-Bannâ (1256-1321), born in Marrakech (Morocco). In this treatise, on the basis of philosophical or mathematical arguments the author justifies certain definitions of the ‘Science of Arithmetic’, like those that relate to the concepts of unity, number and base, definitions that he had given in his famous work on arithmetic, *Talkhîs*, and that had been criticized by his contemporaries. In this sense this treatise is a commentary of *Talkhîs*. But at the same time ‘Science of Arithmetic’ is a complement of
Talkhîs as it contains some original contributions, like the demonstration of the famous rule of signs, the justification of the algorithm for the square and cubic root of arbitrary whole numbers, the demonstration of the existence of solutions of quadratic equations by a procedure that had been completely freed from geometry and finally the deduction of propositions, like the one that permits it to express the number of combinations of n objects taken p at a time, with the help of an arithmetical formula.

ABA-89

ABA-92

The article presents certain aspects of the intervention of fractions in Ibn al-Bannâ’s mathematical papers, in particular as tools allowing to express and to resolve problems of inheritances and as objects of a theoretical study within the framework of the reflection of this author on the notion of number.

ABA-94
1994 Aballagh, Mohamed: To take the veil of the methods of calculation of Ibn al-Bannâ al-Murrâkushî (d. 721/1321), Publications de la Faculté des Lettres et Sciences Humaines, No. 5, Université Sidi Mohamed Ben Abdallah, Dhar el-Mehrez, Fez (Morocco), 360 p. (in Arabic).

Translation into Arabic (preceded by a new Introduction) of the doctoral thesis that Mohamed Aballagh defended on May 5, 1988, at the University of Paris I-Panthéon-Sorbonne (ABA-88).
The author presents information concerning the circulation of mathematics in the north of Africa through the example of three works of Ibn al-Bannâ.

Contains five chapters: 1. Islamic patterns and their geometrical construction (1-28), 2. In praise of pattern, symmetry, unity and Islamic art (29-44), 3. The gateway from Islamic patterns to invariance and groups (45-72), 4. Classification, identification and construction of the seventeen types of two-dimensional periodic patterns (73-134), 5. Islamic patterns and their symmetries (135-139), Examples (140-388). Includes various examples from North Africa.

"This is the first part of a study on the teaching of mathematics in 19th century Tunisia. The paper starts by introducing the historical context, in particular the reforms promoted by Mehemet Ali in Egypt and by Chekir Sahab at-Tabaa and Mustapha Khaznadar in Tunisia. Then we describe the teaching of mathematics in the traditional school system at the Zitouna and the parallel development of a modern educational
system embodied by the Military School of Bardo (1840-1864) and by the Sadiki College (1875)."

ABD-02
2002 Abdeljaouad, Mahdi: *Introduction à l'arithmétique* [Introduction to arithmetic], Centre des Publications Universitaires, Tunis (Tunisia), 270 p. (in French).

In this handbook for first year university students the author presents a chronology of arithmetic that gives its place back to the contribution of the Arabs. Each chapter concludes with an historical appendix that shows how each civilization contributed to the development of the concerned concepts.

ABD-03

Edition accompanied by commentaries in Arabic and in French, of a work by the Egyptian mathematician Ibn al-Hâ’im (1352-1412). This work is entirely dedicated to a detailed commentary of the algebraic poem *al-Yâsamîniyya* of the Maghrebian mathematician Ibn al-Yâsamîn (d. 1204).

ABD-04a

ABD-04b
The author dedicates an important section to bilateralism in certain periods of the history of Arab mathematics.

**ABDUL-95**

**ABDU-93**

The work contains 15 chapters that deal with the life of the mathematician Ibn al-Haytham and his contributions to different mathematical fields, like the conics, the calculation of areas and volumes, the regular heptagon, the lunes; and to geometrical optics.

**ABE-52**

**ABU-73**

**ACT-88**

The proceedings of the first International Colloquium on the History of Arabic Mathematics, held in Algiers, Algeria (1986), include the following contributions:

* Souissi, M.: The Maghrebian mathematical school: some examples of its works and certain of its particularities (9-24)
* Sadallah, A.: Some scientific practices in Algeria during the period of scientific retardation (15th –18th centuries) (25-36)
* Sesiano, J.: The Liber Mahamaleth, a Latin mathematical treatise composed in the 12th century in Spain (67-98)
* Djebbar, A.: Some aspects of algebra in the mathematical tradition of the Mussulman West (99-124)
* Bebbouchi, R. & Taleb, K.: The infinitely great quantities of Thâbit Ibn Qurra (125-132)
* Abdeljaouad, M. & Hedfi, H.: Towards a study of the historical and mathematical aspects of the open problems of Ibn al-Khawwâm (13th century) (155-178)

ACT-91


The proceedings of the second Maghrebian Colloquium on the History of Arabic Mathematics, held in Tunis, Tunisia (1988), include the following contributions:
* Abdullatif, A.: The lunes of Ibn Al-Haitham (in Arabic, 40-67; French summary p.195)
* Atik, Y: The algebraic epistle of Sinân Ibn al-Fath (10th century) (5-19)
* Benrebia, Y.: Mechanical geometry in the Arab mathematical tradition (in Arabic, 143-152)
* Bebbouchi, R.: The infinite and the Arab mathematicians (20-26)
* Borowczyk, J.: Proof and complexity of the algorithms for the solution of polynomial equations by al-Tûsi and Viète (27-52)
* Bruins, E.: Mathematics before and after the so-called Islamic period (in Arabic; summary in French, 196)
* Djebbar, A.: Some new elements on the Arabic mathematical activities in the East Maghreb (9th – 16th century) (53-73)
* Dold-Samplonius, Y: Al-Kâshî’s measurement of Muqarnas (in English, 74-84)
* Folkerts, M.: The Arabic Euclid in the Latin West (85-94)
* Guillemot, M.: From Egyptian arithmetic to Arabic-Islamic arithmetic (95-105)
* Hadfi, H.: The book of Data (al-mafrûdât) of Thâbit Ibn Qurra (in Arabic; summary in French, 197-198)
* Hamzaoui, R.: About unification and normalization of Arabic scientific terminology (in Arabic; summary in French, 199)
* Jaouchi, K.: Some aspects of the evolution of the role of geometry and algebra from the 9th to the 13th century (106-124)
* Kane, A.: Arabic alphabetic numeration and decimalization of the Mandé numeration systems (West-Africa) (in Arabic; French summary p.200)
* King, D.: An overview of the sources for the history of astronomy in the medieval Maghreb (in English, 125-157)
* Laïb, A.: Infinitesimal determination through the epistle of Ibn al-Haytham on the volume of the sphere (in Arabic; French summary p.202)
* Lorch, R.: Remarks on Greek mathematical texts in Arabic (in English, 158-163)
* Martzloff, J.: The contacts between Arabic and Chinese astronomy and mathematics principally seen from Chinese sources (164-182)
* Saïdan, A.: Mathematics between the Islamic West and East (in Arabic; French summary p.203)
* Sesiano, J.: The place of geometry in establishing the foundations of Islamic algebra (183-194)
* Souissi, M.: Some problems and their Arabic solutions (in Arabic; French summary p.205)
* Zemouli, M.: Birth and evolution in the Arabic algebraic terminology (in Arabic; French summary p.206)
* Zerrouki, M.: Fractions in the Maghrebian mathematical tradition between the 12th and the 15th century through an anonymous manuscript (in Arabic, 97-109)
ACT-98a

The proceedings of the 3rd Maghrebian Colloquium on the History of Arabic Mathematics, held in Tipaza (Algeria, 1990), include the following contributions:

* Alaoui, J.: The problematics of the links between mathematics and metaphysics or from mathematics to the first philosophy in the work of Ibn Rushd (Vol. 2, 105-107, abstract)
* Bebbouchi, R.: Arabic heritage in the redaction and the explication of mathematical texts (5-11)
* Berggren, J. L.: Geometric Methods in Medieval Islam: The case of the Azimuth Circles (13-21, in English)
* Brentjes, S.: The Arab transmission of the Introduction to Arithmetic in non-mathematical works during the 9th century (23-29)
* Calvo, E.: The graphic resolution astrologic questions in Andalusia (31-44)
* Cassinet, J.: The fund of ancient Arab mathematical manuscripts in the Laurentian library in Florence (45-59)
* Comes, M.: The deferent of Mercury in the al-Andalus’ Equatoria, (61-71, in English)
* Dhombres, J.: The theory of proportions in the 17th century: Variety of Arab or Latin influences based on Greek foundations, and new developments (277, abstract)
* Djebbar, A.: Mathematical activities in the cities of the Central Maghreb (9th - 14th century) (73-115)
* Folkerts, M.: Remarks on al-Khwârizmî’s Arithmetic (117-123, in English)
* Gari, L.: The unity of measurement in Islamic architecture (Vol. 2, 39-63)
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* Guergour, Y.: Introduction to the art of geometry of Qustâ Ibn Lûqâ (m. 910) (Vol. 2, 65-71)
* Guillemot, M.: The methods of simple false position in Egyptian and Arab mathematics (125-145)
* Hogendijk, J. P.: The study of conic sections in the Arab tradition (147-158)
* Hoyrup, J.: “Oxford” and “Gherardo da Cremona” on the relation between two versions of al-Khwârizmî Algebra (159-178, in English)
* King, D. A.: Magrebi Astronomical Instruments (278, abstract, in English)
* Koelblen, S.: Ahmad Ibn Yûsuf and his treaty on the theory of proportions (195-206)
* Laabid, E.: The donations in medieval mathematics, the example of al-Hubûbî (207-220)
* Lapousterle, P.: Description of three mathematical manuscripts in the Ahmed Baba library of Timbuktu (Mali) (277-278, abstract)
* Martzloff, J. C.: The Qi Zheng Tuibu of Bei Lin (vers 1477) (227-237)
* Mili, A.: Breathe life into arithmetic algorithms of the past millennium (Vol. 2, 107, abstract)
* Rebstock, U.: If Numbers are right: on the Use of Reckoning in the Islamic Middle Age (239-249, in English)
* Sesiano, J.: Some constructions of simple magic squares in Arab texts (251-262)
* Shawqi, J.: The science of magic squares in Islamic civilization (Vol. 2, 104, abstract)
* Souissi, M.: The teaching of mathematics in Arabic in the Maghreb, particularly in Tunisia during the 13th century and in the first half of the 14th century of the hegira (Vol. 2, 31-37)

ACT-98b
1998b *Actes du 5e Colloque Maghrébin sur l’Histoire des Mathématiques Arabes* [Proceedings of the 5th Maghrebian Colloquium on the History of Arabic Mathematics], Imprimerie Impak, Tunis (Tunisia), 257 p. (most papers are in French)

The proceedings of the 5th Maghrebian Colloquium on the History of Arabic Mathematics held in Tunis, Tunisia (December 1-3, 1994), include the following contributions:
* Ben Miled, M.: Undecidability in the work of as-Samaw’al (7-11)
* Bebbouchi, R.: The memory of symbols from Antiquity to our days (12-20)
* Berggren, J.L.: Abû Sahl on a Lacuna in Archimedes (in English) (21-26)
* Calvo, E.: Analysis of six geometrical models to calculate the length of the solar year in Ibn al-Hâ’im’ “al-Zîj al-Kâmîl fi l-Ta’âlîm” (in English) (27-39)
* Cassinet, J.: The treatise concerning the methods of numerical problems by al-Husayn as-Samarqandi (d. 1235) (40-48)
* Djebbar, A.: The Euclidian arithmetic tradition in the Kitâb al-istikmâl of al-Mu’taman and its continuation in Andalusia and in the Maghreb (62-84)
* Dold-Samplonius, Y.: Al-Kâshî’s Constructions of Arches, Vaults and Domes (in English) (85-100)
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* Guergour, Y.: Comparative study of the species 2 and 3 of the book *Istikmâl* of al-Muʿtaman ibn Hûd (d. 1085) (in Arabic, 31-46)
* Guillemot, M.: Is it possible to speak of methods of false position in the case of Egyptian mathematics? (120-147)
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* Lamrabet, D.: The reasons for the study of mathematics according to some Maghrebian scholars (101-108)
* Mawaldi, M.: Edition and study of the epistle The redaction of Taqīy ad-Dīn Ibn Maʿrūf of the two proofs of the Banū Mūsā brothers of Heron’s formula (47-58)
* Pinel, P. & Taha, A.: On a premature, anonymous Arabic version of Menelaus’ Sphaerica conserved in the Latin translation of Gérard de Crémone (198-225)
* Samso, J.: The tables of planetary equations in the Minhāj of Ibn al-Bannā (263-272)
* Schubring, G.: Actual tendencies in the research on the institutional history of the sciences and its application to the Islamic culture (273-283)
* Souissi, M.: Epîstle of al-Kindî on the determination of the dimensions of an optical instrument (in Arabic, 9-30)
* Taha, A.: Note on Menelaus’ Sphaerica of in the version of at-Tûsî (284-296)

ACT-98c

These proceedings of an international colloquium held in Marrakech on “Geometrical Reasoning, Teaching and Learning” (May 28-31, 1997) include the following papers related to the history of mathematics in Africa:
* Ahmed Djebbar: Geometrical reasoning in the Arab mathematical tradition (9th –15th centuries) (89-121)
* A. El-Idrissi: The instruments used in geometrical reasoning: history and didactics (134-144).
ADA-82
1982 Adaaku, J.: The mathematical heritage of the Tiv people, M.Ed. project, Ahmadu Bello University, Zaria (Nigeria).

ADD-66

ADJ-95

Discusses the calculation of the area of a circle (Papyrus Rhind) and of the surface of a hemisphere (Moscow Papyrus).

ADL-88

ADL-91

ADL-95

ADL-96

ADL-01
AFO-90  

AGB-69  
1969 Agbo, Casimir: *La numération au Dahomey*, Études Dahomeennes (Nouvelle Série), Porto Novo (Benin), Nos. 14-15, 59-110; 1970, No. 16, 5-112. Study concluded in 1942. It presents the numerals in several languages spoken in the Republic of Benin: Fon or Fongbé, Mina or Ghen, Ghin or Ghinbe, Nagot or Yoruba.

AGW-98  

AHMA-92  

AHR-22  

AIS-92a  

Several papers confirm the existence of an important mathematical school in Béjaïa (Algeria) during the Middle Ages. The objective of this article is to clarify the strategy of the GEHIMAB association concerning the exhumation of testimonies: history of its education, methods and disciplines (name, objects, tools, algorithms, proofs and domains), of the outstanding personalities of the time.
AIS-92b

Indicates the possible educational, didactic and cultural impact that the exhumation of testimonies of mathematical activities in medieval Béjaïa may have on the current education.

AIS-93
1993 Aïssani, Djamil: Bougie à l’époque médiévale: les mathématiques au sein du mouvement intellectuel [Béjaïa during the Middle Ages: Mathematics within the intellectual movement], IREM de Rouen, Rouen (France), 112 p. (in French).

Analyses the bio-bibliographical sources and presents a synthesis of testimonies known on mathematical activities about Béjaïa in the Middle Ages. In particular, the author indicates names on which the attention of the specialists of the history of sciences did not yet focus, and he proposes a certain number of tracks of reflection and study that would allow to analyse better the contents of studied disciplines.

AIS-94

The article presents the political, cultural and economic context in which the scientific activities in Béjaïa were developed during the Middle Ages. It describes some aspects of mathematical production in this city (science of calculation and algebra) and it concludes with a remark about Fibonacci, who had studied mathematics in Béjaïa.
The first part of the paper analyses the structure of the scientific environment in medieval Béjaïa, as well as the Mediterranean peculiarities that have played a role in the development of mathematical activities. The second part concerns the role of the city as a centre of influence and exchange with Christianity. The process of transmission is evoked through a dozen scholars, who were native of various regions of the Mediterranean, and who were specialized in different mathematical disciplines.

Overview of research realised during the last decades about the role of Béjaïa as a scientific centre in the 12th and 13th century.

Presents some aspects of the investigations of the French geometer Eugène Dewulf, founding member of the Mathematical Society of France, concerning Maghrebian medieval manuscripts.

The Ulahbib Collection regroups the manuscripts found in the Khizana (learned library of manuscripts) of the Sheik Lmuhub. This library was established in the middle of 19th century in the mountain of Beni.
Ourtilane in the Southeast of Kabylia (Algeria). The catalog is the first of this kind on the manuscripts of Kabylia. The manuscripts are classified by discipline, among which: Science of calculation (15 - 19), Algebra and Geometry (20 - 21), Science of Inheritance (22 - 27), Astronomy (28 - 33), Astrology (34 - 40), Logic (106 - 111).

AIS-98a

Presents an overview of 900 years of mathematical activities in Algeria. Three aspects are discussed: (1) The contribution of the Algerian centers of knowledge to the creation of the medieval mathematical tradition of the Maghreb; (2) The mathematical knowledge of the local Algerian scholars in the 18th and 19th century; (3) The contribution of several French mathematicians in Algeria (François Arago, Eugène Dewulf, Albert Ribaucour, ...).

AIS-98b

Regroups the information collected during the investigation that led to the elaboration of the Catalog of the Ulahbib Collection of manuscripts (Béjaïa). In particular, it tries to indicate the knowledge available to the local scholars in Kabylia in the middle of the 19th century. Chapters 8 and 9 are dedicated to the mathematical disciplines (55 - 80).

AIS-99a
1999 Aïssani, Djamil: Centri del Sapere Maghrebino ed i loro Rapporti con l’Occidente Cristiano [The Maghrebian Centres of knowledge and their relationship with the Christian West], in: Proceedings of the International Seminar “Natura, Scienza
Based on subjects already analysed by the Italian National Commission of UNESCO (Elaboration of knowledge, circulation of knowledge, history of journeys and travelers, borders and contact zones of in the Mediterranean), this article tries to describe the contribution of the Maghrebian centres of knowledge in the process of the development of scientific knowledge, since the period with translations (in the East), until the fixation of the medieval mathematical tradition of the Maghreb.

AIS-00a

The author proposes a synthesis of testimonies known (of bio-bibliographical or scientific sources) on mathematical activities in Qal`at Beni Hammad from the 11th to the 13th century, giving information on the connections with Ifrikiya. He analyses the influence of the educational tradition of Qal`at on the development of mathematical activities in Béjaïa.

AIS-00b

After having continued up to Barcelona the first measurement of the terrestrial meridian, the famous French mathematician François Arago (1786-1853) made a spectacular visit of Kabylia (1808). He lectured afterwards the first course of both theoretical and applied probability theory in France, entitled “social arithmetic”. Besides the presentation of Arago’s “Algerian observations”, the purpose of this article is to stimulate a reflection on the teaching of probability theory in Algeria during the last twenty-five years.
This article presents one of the most renowned religious and scientific centres of Northern Africa. Founded at the beginning of 18th century, the Zawiyya of Chellata was the centre of activity of the renowned astronomer Mohammed Ben Ali Cherif ash Shellati, commentator of the as-Susi. A presentation and an analysis of the work *Ma`alim al-Istibsar bi Tafdhil al-Azman wa Manafi` al-Bawadi wa l-Amsar* (commented overview of the times and benefactions of the regions and the countries), more known in Kabylia under the name of *Hashiyat Ibn `Ali Sherif `ala `Ilm al-Falak Susi*, are included.

This article analyses the relationship between the environment in which the Italian mathematician Léonardo Fibonacci (1170-1240) lived, notably the environment of traders from Pisa in Béjaïa (Algeria), and the formulation of his mathematical knowledge. Indeed, in the first part of the *Liber Abaci*, the explanations and demonstrations of Fibonacci are constantly based on examples and problems which come from the daily activities of these traders and sailors: problems of exchange, weights and measures, of loads of vessels, of price calculations. Also, the products, which appear are mostly those that one finds on the market of Béjaïa.
Mathematics in African History and Cultures

AISS-83

AJO-78

Examines the research that has been done in mathematics education in Africa. It discusses the scope and the significance of these studies and concludes with an outline of needed research

AKI-85

AKIN-92
1992 Akinyele, O.: Adegoke Olubummo [1923-1992]: The man, the teacher, the mathematician, in MEM-92, i-ii.

AKK-02
2002 Akkar, Mohamed: L’enseignement des mathématiques dans l’enseignement secondaire maghrébin [Mathematics teaching in secondary schools of the Maghreb region], Zentralblatt für Didaktik der Mathematik - International Reviews on Mathematical Education, Karlsruhe (Germany), Vol. 34, No. 4, 179-185 (in French).

Analyses “the following questions. Does the mathematics teaching in the secondary schools in the Maghreb prepare to University studies and more specifically does it initiate students to modern science and technology? Is anyone able to understand mathematics or is mathematics only accessible to the happy few. Is it a means of selection? Is mathematics omnipresent in our modern society? What relationships can one hope to find between mathematics and other disciplines? Has mathematics evolved to such an abstract and formal
state that it seems difficult to relate it to any other topic? All these questions are discussed in relationship with the particular problems in the Maghreb, namely the mathematics program as taught today in these countries.”

AKO-88

ALB-90

Describes the symbolical significance or use of the numbers two, three, four, five, six and seven in various African cultures.

ALA-01

Investigates how Namibian secondary school students perceive their mathematics classroom environments, particularly determining differences in perception that can be attributed to students’ and teachers’ gender and the interaction between the two. The study was carried out in the Khorixas educational region of Namibia.

ALBE-91
Gives examples of the oral mathematics used by the nomadic Fulani (Nigeria): elements of statistics, inequality, probability, geometry, and basic algebra, and suggests that a relevant curriculum for rural communities must build upon the mathematics existing in these communities. The paper shows also how the Fulani use symbols to represent the number of cows or goats they possess: 100 is represented by two short sticks in the form V, 50 by two sticks in the form X, 10 by one stick _, 3 by three sticks |||, etc.

Deals with numerals, arithmetic operations, measurement, monetary system and time reckoning in Guinea-Bissau.
particular, it analyses the formation of new scientific terms by composition, semantic shift and borrowing.

ANG-97

ANI-92

Introduction to special issue in honour of Professor Chike Obi, 114 p.

ANS-96

Presents a comparative analysis of number words in Ancient Egypt and several African languages. The chapter analyses different ways of counting and presents a ‘human ecology’ of the numbers in Ancient Egyptian.

ANT-98

ANZ-88

Reports on field work on mathematical algorithms used by unschooled, illiterate of the Igbo, Tiv and other home communities of the students in the southern part of Kaduna State (Nigeria).
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ARC-27
1927 Archibald, Raymond Clare: Bibliography of Egyptian mathematics with special references to the Rhind mathematical papyrus and sources of interest in its study, Mathematical Association of America, Oberlin O. (USA), 84 p.

ARC-50

ARG-94

Collection of articles of which the majority are dedicated to Heron of Alexandria (1st century) and his contributions to mechanics and mathematics.

ARI-65

This catalogue contains over one thousand manuscripts, including manuscripts about mathematics and astronomy.

ARM-62

“The traditional Yoruba numeral system is a fascinating chapter in the history of mathematics and of the development of human thought. It is a vigesimal system, which is to say that it reckons the higher numbers by twenties (ogún). Thus ‘forty’ is ‘two twenties’ (ogójì, from ogún èjì) and ‘sixty’ is ‘three twenties’ (ogóta). … it is based on finger-and-toe counting … ” (p. 5). The author proposes a decimal number system “which uses Yoruba words throughout and in a regular way” (p. 21).
ARM-71
Brief manual prepared for the use of Yoruba speaking primary teachers of Entebbe Mathematics (Africa Mathematics Program).

ARO-95

ART-99

ASA-88

ASC-88
1988 Ascher, Marcia: Graphs in cultures (II): a study in ethnomathematics, Archive for History of Exact Sciences, Berlin (Germany), Vol. 39, No. 1, 75-95.
This paper discusses and analyses interest in continuous tracing of figures as it is evidenced in Africa among the Bushoong and Cokwe (Angola / Congo / Zambia region). Included are figures, statements about the cultural context, and associated geometric and topological ideas. Emphasis is on the structure of the figures and also, where possible, processes of construction are elaborated.

ASC-90
Analyses the logical structure behind traditional story puzzles from Algeria, Cape Verde Islands, Ethiopia, Liberia, Tanzania, Zambia.
Sections 2.3 and 2.4 deal with mathematical aspects of sand drawings among the Kuba (Congo / Zaire) and the Cokwe (Angola); section 4.8 deals with mathematical aspects of river-crossing puzzles.

Translation: ASC-98.

ASC-97

“Sikidy is a system of divination that plays a significant role in the lives of the people of Madagascar. Here we focus on the mathematical ideas, which it embodies. Formal algebraic algorithms are applied to initial random data, and knowledge of the internal logic of the resulting array enables the diviner to check for and detect errors. Sikidy and the mathematical ideas within it are placed in their cultural and historical contexts.”

ASC-98

French edition of the already classical study ASC-91. Translation and afterword by Karine Chemla and Serge Pahaut.

ASC-00

ASC-02
Some sections are related to the African continent. The first chapter is about divination and includes detailed discussions of Sikidy, as practiced in Madagascar, and Ifa, as practiced by the Yoruba (Nigeria). In the third chapter, which is about calendars, there is a brief mention of the Akan calendar. The fifth chapter includes a detailed discussion of the Gada system (essentially a system of social organization) of the Borana. And the seventh chapter has brief mentions of the Cokwe sono (Angola) and designs of the Kuba (Congo).

ASC-03

ASH-00

ASS-00

Analysis of the arithmetical, algebraic, geometrical and trigonometric tools which intervene in the statement and the resolution of the problems of astronomy and more particularly those that are related to the various instruments described in the work of al-Murrâkushî.

ATK-61

Describes “the diversity of grammatical forms of the Bantu numerals as a whole.”

AUJ-86
1986 Aujac, Germaine: Le rapport ‘di isou’ (Euclide V, définition 17): Définition, utilisation, transmission [Le relationship ‘di
isou’ (Euclid V, definition 17): Definition, utilisation, transmission], Historia Mathematica, New York (USA), Vol. 13, No. 4, 370-386.

AUJ-93
1993 Aujac, Germaine: La Sphère, instrument au service de la découverte du monde: D’Autolycos de Pitane à Jean de Sacroboso [The sphere, instrument in the service of the discovery of the world: From Autolycos of Pitane to John of Sacroboso], Paradigme, Caen (France), 380 p.

The articles in this collection are grouped under three headings: 1. Spherics and geocentrics; 2. Spherics; 3. Practical applications. The following contributions concern the history of mathematics in Africa: Euclid and Spherics (151-156); Greek geography in Alexandria in the 2nd century (347-368).

Review: VIT-95.
BAB-02

Paper based on the author’s experience at the University of Botswana.

BAD-97

BALL-97

“This paper stresses the principal sources of interest in and the level of knowledge of mathematics in the 19th century in Small Kabylia (Algeria). The recent discovery in the Ath Urtilan area of a scholarly library of manuscripts (the Ulahbib Collection) allows some conclusions through a method of mathematical analysis of social facts.”

BAN-66a
1966a Bantu Education Department: *Proposed contracted numerals for northern Sotho*, *Bantu Education* (South Africa), February, 12-16.

Proposal by Radio Bantu of contracted numerals for northern Sotho (South Africa).
BAN-66b
1966b Bantu Education Department: Proposed improvement on contracted numerals for northern Sotho, *Bantu Education* (South Africa), September, 17-21.

BAN-69
1969 Bantu Education Department: Northern Sotho numerals, *Bantu Education* (South Africa), August, 5-6.

Presents the contracted numerals for northern Sotho officially recognised by the Lebowa Territorial Authority (South Africa).

BARN-87
1987 Barnard, Anna: *‘n Histories-pedagogiese onderzoek na die opleiding van wiskunde-onderwysers vir die primêre skool* [A historic-pedagogical investigation of the training of mathematics teachers for primary schools], doctoral thesis, University of Pretoria (South Africa) (in Afrikaans).

BAR-71
1971 Barreto, Manuel Cabrera: *Die Zahlwörter der Altkanarier* [The number words of the ancient Canarians], *Almogaren*, Hallein (Austria), Vol. II, 151-167 (in German).

“The author examines critically the information available regarding the numerals in the language of the natives of the Canary Islands. Their basis of counting is the decimal system, which is clearly proven by all recent critical and historical studies. Ancient Canarian and Berber numerals are closely akin as regards language and counting, which shows the North African origin of the ancient Canary islanders also in this domain. Apparently Semitic traits can be explained by the presence of Negro and Berber slaves in the Canary Islands, as stated by Bosch Millares, an assumption which is better established than that of a linguistic hybridization of the Canarian natives” (p.167).

BARR-93a
1993a Barrios García, José: *Notas sobre los conocimientos matemáticos y astronómicos de los Benahoaritas, según las fuentes escritas anteriores al siglo XVII* [Remarks about the mathematical and astronomical knowledge of the Benahoaritas according to written sources before the 17th century] (paper

BARR-93b

BARR-94a
1994 Barrios García, José: Notas sobre los conocimientos matemáticos y astronómicos de los antiguos palmeros según fuentes escritas [Notes about the mathematical and astronomical knowledge of the ancient inhabitants of Las Palmas according to written sources], in: *I Encuentro de geografía, Historia y Arte de la Ciudad de Santa Cruz de La Palma*, Santa Cruz de la Palma (Canary Islands, Spain), Vol. 1, 112-118 (in Spanish).

“Drawing evidence from archaeological and ethnographical literature, this paper summarizes a number of mathematical practices of the Berber populations of the Canary Islands in the 14th – 15th centuries, in relation with their economical and socio-cultural context.”

BARR-94b
1994 Barrios García, José: La lista de numerales canarios atribuida a Antonio Cedeño [The list of Canarian numerals attributed to Antonio Cedeño], in: *X Coloquio de Historia Canario-Americana, Las Palmas de Gran Canaria*, Cabildo Insular (Canary Islands, Spain), Vol. 2, 859-878 (in Spanish).

Analyses Cedeño’s list (about 1687) of Berber numerals from the Canary Islands and compares it to other reported lists of these numerals.
BARR-96a

“Study of the lunar calendar of the Berber populations of Tenerife island in the 14th – 15th centuries, the so called Guanches, mainly based on the ethnographic written sources arisen from the Spanish conquest in late 15th century. It is argued that the first moon of the Guanche lunar calendar was fixed by the heliacal rise of Canopus about middle August. The Guanche cult to this star was later transferred to the main catholic cult of the island after the conquest: the Virgin of Candelaria.”

BARR-96b
1996 Barrios García, José: Cuentas que pasaron ante Juan de Anchieta, escribano público. Un estudio sobre los sistemas de numeración y algoritmos de cálculo utilizados en Tenerife a mediados del siglo XVI [Reckoning in front of Juan de Anchieta, the public scribe. A study of the numeration systems and algorithms used in Tenerife in the middle of the 16th century], in: Morales Padrón, F. (Ed.), XI Coloquio de Historia Canario-Americana (Las Palmas 1994), Cabildo, Las Palmas de Gran Canaria (Canary Islands, Spain), Vol. 1, 409-426 (in Spanish).

“An arithmetical study of the protocols of the notary Juan de Anchieta (father of José de Anchieta, apostle of Brazil), preserved at the ‘Archivo Histórico Provincial de Santa Cruz de Tenerife’, and dating from 1541.”

BARR-97a
1997a Barrios García, José: Sistemas de Numeración y Calendarios de las Poblaciones Bereberes de Gran Canaria y Tenerife en los Siglos XIV-XV [Numeration systems and calendars of the berber populations of Grand Canary and Tenerife in the 14th and 15th century], doctoral thesis, Universidad De La Laguna, Tenerife (Canary Islands, Spain), 244 p. (in Spanish).
“Doctoral thesis on the number systems and calendars used by the Berber populations of Grand Canary (Canarians) and Tenerife (Guanches) in the 14th and 15th centuries. It is established for both islands the use of a pure 10-based system (deeply related with both proto-Berber and ancient Egyptian numeral systems), the existence of census of their inhabitants, as well as the existence of systematic records of lunar, solar and sidereal counts. Notwithstanding several basic similarities, the calendrical practices of both islands show several conceptual differences. On the one hand, the Canarians recorded numerical, astronomical and calendar data by means of geometrical figures (squares, triangles, circles, etc.), painted in black, red and white, using the *acano* (a chessboard of 3 x 4 squares representing 12 moons), to record data, as well as to perform ‘lunisolar’ and eclipse counts; nothing of which can be documented for the Guanches. On the other hand, in contrast with some (weak) notices supporting the existence of a Sirius calendar in Grand Canary, the main result with respect to the Guanche calendar is the fundamental role played by the phases of the star Canopus. Additional evidence drawn from continental Berbers, supports the antiquity and widespread of a Canopus cosmological system in Northwest Africa.”

BARR-97b

Paper presented at a meeting of the SEAC (Société Européenne pour l’Astronomie dans la Culture; European Society for Astronomy in Culture). The paper presents the ‘acano’ as a Berber lunar calendar and shows “how to number its squares to force the solistical, equinoctial and eclipse moons to move across the board with very simple and stable patterns. These patterns provide a safe and clear mnemonic guide for performing on the acano an easy calculus of seasonal and eclipse moons over extended periods of time, just using the difference in days of the lunar year with either the solar year or the eclipse year to perform an elementary saw function on the squares. This calculus establishes the octaeteris, the metonic cycle and the 135-moon eclipse cycle as basic periods of the ‘acano’. … The proposed calculus on the acano would reveal an unsuspected high level of Canarian
BARR-98

“In spite of its title, Claudia Zaslavsky’s book Africa Counts is admittedly devoted to sub-Saharan cultures, as clearly shows the great blank recovering all the north-western part of the different distribution maps depicting the entire continent … The purpose of the presentation is, precisely, to contribute to fill this notable void in Zaslavsky’s book, presenting sound evidence about the number system used by the Berber populations of Grand Canary Island in the 14th – 15th centuries, considered against its wider North African context. While briefly summarizing the role of mathematics in the socio-economical organization of the Island, the paper stresses the importance of the Canarian studies in relation to modern research on ancient North African mathematics.”

BARR-99

Paper presented at a meeting of the SEAC (Société Européenne pour l’Astronomie dans la Culture; European Society for Astronomy in Culture). “The first part of the paper analyses the archaeological, ethnohistorical and linguistic evidence that led the author to propose that in the 14th and 15th century the Berber populations of Grand Canary Island systematically recorded numerical, astronomical and calendar data by means of certain geometrical figures named ‘tara’, painted in white, red and black on wooden planks and on the walls of certain caves. One main conclusion of the study was the discovery of
the use of a type of chess board of 3 vertical x 4 horizontal squares, named ‘acano’ by the author, to represent 12 moons.”

BARR-00
2000 Barrios García, José: Sobre la existencia de censos de población entre los antiguos Canarios (Gran Canaria, Siglos XIV-XV) [On the existence of population census among the ancient Canarians (Grand canary island, 14th – 15th centuries)], in: Morales Padrón, F. (Ed.), XIII Coloquio de Historia Canario-Americana, Ediciones del Cabildo de Gran Canaria, Las Palmas de Gran Canaria (Canary Islands, Spain), 1697-1704 (in Spanish).

“Paper gathering the ethnographical written sources supporting the existence of systematic census of inhabitants carried out by the Berber populations of Grand Canary Islands in the 14th - 15th centuries, just those preceding the Spanish conquest of the Island.”

BARR-02a

“The first part of this paper opens with a very brief summary of what is known about the Guanches (ancient Berber inhabitants of Tenerife island) in the 14th - 15th centuries, and goes on analyzing the archaeological and ethnographical evidence documenting their use of marks on the mummies, strings of clay beads, as well as marks and pictures on wood planks and stones for recording several kind of data, mainly calendar and numerical ones.”

BARR-02b
“The second part of this paper studies the numeral systems used by the ancient inhabitants of Tenerife Island to perform several economical and socio-cultural practices as mentioned in the written ethnographic sources. On this ground an hypothesis is formulated about the numeral systems used, the name of the numbers and the scope of the system.”

BARRO-01

BAS-75

BASH-97

Presents the works of Diophantus of Alexandria, focusing on Diophantus’ general methods of obtaining rational solutions of indeterminate equations of the second and third order. The second part of the book considers the evolution of the theory of Diophantine equations from the Renaissance to the middle of the 20th century.

BAU-95

BAZ-95
1995 Bazin, Maurice & Modesto Tamez: *Math across cultures*, Exploratorium Teacher Activity Series, San Francisco CA (USA), 48 p.
Booklet with suggestions for teachers on how to use a multicultural approach in the maths classroom. Chapter 3 is on mathematics in Africa: *Counting like an Egyptian: Egyptian math* (23-32).

**BAZ-02**

Papers with activities related to mathematics from Africa are:
* Paulus Gerdes: Sona: Sand drawings from Africa (3-15)
* Robert Lange: Madagascar Solitaire: Playing Games (25-31)
* Maurice Bazin & Modesto Tamez: Counting like an Egyptian: Egyptian math (47-59).

**BEA-55**
1955 Beart, Charles: *Jeux et jouets de l’ouest africain* [Games and toys of West Africa], Institut Français d’Afrique Noire (today: Institut Fondamental d’Afrique Noire), Dakar (Senegal), 2 volumes, 800 p. (in French).

Presents a descriptive inventory of the West-African games collected by the author. Among the games with mathematical aspects are: Order games (arrange and collect), Combination games like checker-board games as ‘awalé’, hop-scotch playing, ‘tiouk-tiouk’, ‘dili’, magic squares and games that resemble the game of draughts, and Gambling games (cowry games).

Review: DOU-89.

**BEC-57**

Includes chapters on mathematics in Egypt.

**BEC-61**
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pyramids of the Old Kingdom], *Praxis der Mathematik*, Köln (Germany), Vol. 3, 260-266 (in German).

BEL-02


Analyses the structure of the Arabic- and English-free number words in the Hausa language (Nigeria). The indigenous Hausa number system has base ten, with numerals for the first four powers of ten. Both the additive and the subtractive principles are used. For instance, 98 is expressed as ‘xari ba goma’ (100 less 2).

BELL-95


BENC-74


BEN-92

1992 Benoit, Paul; Chemla, Karine & Ritter, Jim (Eds.): *Histoire de fractions, fractions d’histoire* [History of fractions, fractions of history], Birkhäuser Verlag, Basel (Switzerland), 436 p. (in French).

Proceedings of the international colloquium on the History of Fractions held in Paris, France (1987). The following chapters concern the history of mathematics in Africa:

* J. Ritter: Metrology and the prehistory of fractions (19-35);
* M. Caveing: The arithmetic status of the Egyptian ‘quantième’ (39-52);
* M. Guillemot: Do notational and operational practices allow us to speak of Egyptian fractions? (53-70);
* A. Djebbar: The treatment of fractions in the Arab mathematical tradition of the Maghreb (223-246);

BENTA-99

Critical edition and translation into French of the commentary written by the mathematician al-Qalasâdî (d. 1486) on the famous handbook “Summary of arithmetic operations” of the Maghrebian mathematicians Ibn al-Bannâ (d. 1321).

BENT-77

BERGD-76

BERI-00

In Guji-Oromo culture (southern Ethiopia), the number nine is associated with critical times, with ghosts, and with illness and death. This is evident in proverbs, in children’s games, and when a woman is pregnant with and gives birth to her ninth child.

BER-87
BER-91

BERTE-92

BERT-02
2002 Bertolini, Marina: *Arte e Geometria nelle Culture Africane* [Art and Geometry in African Cultures], Dipartimento di Matematica, Università degli Studi di Milano, Milan (Italy), 60 p. (in Italian).

Presents an introduction to Gerdes’ studies on geometrical ideas embedded in African cultural activities.

BHA-71

Presents examples of the mismatch between the socialist aims, and both the construction of, and examples used in, the mathematics texts in use in secondary schools in Tanzania.

BIN-96

Presents regional and historical connections of four-tablet divination.

BIS-01
2001 Bisher, Hisham Barakat: *The effect of using Bedouin ethnomathematics in teaching primary stage mathematics courses on the achievement and behaviour in daily life*, Masters
thesis in ethnomathematics, Ain Shams University, Cairo (Egypt) (in Arabic).

Analyses mathematical ideas in nomad Bedouin culture and possibilities to embed them into mathematics teaching.

BLE-00

Presents a “number of solved and unsolved problems” related to Egyptians fractions. The problems which “arise from the oldest known mathematical manuscripts” are “easily accessible to the mathematical novice” (p. 421).

BOC-88

BOG-87

“A small piece of the fibula of a baboon, marked with 29 clearly defined notches, may rank as the oldest mathematical artifact known. Discovered in the early seventies during an excavation of Border Cave in the Lebombo Mountains between South Africa and Swaziland, the bone has been dated to approximately 35 000 BC.” It has been noted that the bone resembles calendar sticks still in use in Namibia.

BON-89
'Maitrise’ thesis in ethnology on numeration and time measurement in three societies of Eastern Africa, discussing the examples of the Borana, the Chaga and the Maasai.

BOP-98

Focuses “on the place of People’s Mathematics for People’s Power in the new South African mathematics Curriculum. Particular attention is given to one aspect of the People’s way of life, botho, that enable blacks to sustain togetherness among the people, through serious economic hardships, leading to the people’s regaining of political strength. Questions are raised as to what extent the framework of the new curriculum provides room for the previously disenfranchised and whether they will be able to gain access to economic and political power through engaging the strength of botho.”

BOU-95

BOUQ-62

Describes the traditional duodecimal numeration system of the Birom (Plateau Province, central Nigeria) and its interaction with decimal systems.

BOUZ-99
1999 Bouzari, Abdelmalek: *Les sections coniques dans la tradition mathématique arabe à travers le traité attribué à al-Khâzin* [The conic sections in the Arab mathematical tradition through...

The thesis contains a historical presentation of the conic sections in the Greek and Arab traditions, a critical edition – on the basis of two existing manuscripts – of a text from the 10th century, attributed to the mathematician al-Khâzin, and a mathematical analysis of the contents of this text.

BOUZ-03

BOW-91

BRA-94

The topics covered in the booklet include: number system, arithmetic and fractions calculations, calendar, measurement of land area and boundaries, standardized weights, construction of pyramids and temples, logical and strategic mathematical games and puzzles. The explanations are followed by activity, resource information sheets for children and notes for teachers.

BREE-03

“This was the title of an energetic Round Table Discussion, which took place during the SAARMSTE Conference in Swaziland in
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January 2003. In the belief that the issues raised are extremely important and need to be debated by the wider community, the main presenters (authors of this article) have attempted to capture the essence of their arguments in this article.”

BRE-97
1997 Brenner, Klaus-Peter: *Chipendani und Mbira: Musikinstrumente, nicht-begriffliche mathematik und die Evolution der harmonischen Progressionen in der Musik der Shona in Zimbabwe* [Chipendani and Mbira: Musical instruments, non-lexical mathematics and the evolution of the harmonic progressions in the music of the Shona in Zimbabwe], Vandenhoeck & Ruprecht, Göttingen (Germany), 559 p. (plus 2 CDs) (in German).


BRE-04

BRI-79

Presents an analysis of the numbers associated with male and female in West Africa. “The opposition and the complementarity of male and female have been brought out in different societies with the aid of pairs of symbols based on left-right, points of the compass, color, etc.
Number also appears to be an apt means of expressing this idea. By studying the rituals of birth and death in West Africa it has been possible to distinguish four pairs of numbers widely associated with male and female: (3,4), (4,3), (9,7) and (5,4). The geographical distribution of these pairs of numbers shows marked grouping. Explanations of the use of the different numbers are generally based on myths or on physiological differences between the sexes and are not very convincing. However, the pairs of numbers are widely used in the ‘numerical system’ of a society that determines the ritual calendar. These systems also make great use of the number 7 and the author contends that not only is this widely seen as the sum of 4 and 3 in areas using that pair but that some evidence can be found that the area using the pair (5,4) tends similarly to use the sum, 9, in its numerical system for the ritual calendar” (p. 376).

BRIT-79

Contains the following papers concerning African countries:
* Kenya: Mathematics in society (30-36)
* Swaziland: Language problems in mathematics education (43-46)
* Swaziland: Mathematics and language (47-51)
* Tanzania: Language problems in teaching mathematics (52-57).

BRO-88

Edited with a preface and an afterword by A. Gurshtein. An overview that besides the contributions of Ptolemy to astronomy includes discussions of his work in optics, music, geography, and astrology.

BROW-81

BRU-45
1945 Bruins, Evert: *Over de benadering van pi/4 in de Aegyptische meetkunde* [On the approximation of pi/4 in Egyptian
Mathematics in African History and Cultures

geometry], Indagationes Mathematica, Amsterdam (Netherlands), Vol. 7, 11-15 (in Dutch).

BRU-52

BRU-57a
1957aBruins, Evert: The icosahedron from Heron to Pappus, Janus, the International Journal for History of Science, Technology, Medicine and Pharmacy, Amsterdam (Netherlands), Vol. 46, 173-182.

BRU-57b

BRU-62
1962Bruins, Evert: Rationalitätsfragen bei Pyramiden [Questions of rationality in pyramids], Praxis der Mathematik, Köln (Germany), Vol. 4, 281-284 (in German).

BRU-64

BRU-65

BRU-75a

BRU-75b
BRU-77

BRU-81a

BRU-81b

BRU-83

BRU-88

BRU-90a

BRU-90b

BRUM-93a

Attempts to understand the methods used to construct the tables in the *Almagest*. 
An explanation for the errors that appeared in the interpolation tables in Ptolemy’s *Almagest*, and a reconstruction of the tables that lends insight into Ptolemy’s numerical methods.

Errors in the numerical tables in Ptolemy’s *Almagest* are usually quite minor. Several auxiliary tables, however, contain some more serious errors. These errors are analyzed and explained.

**BRUM-94**

**BUS-67**

**BUS-68**

**BUS-77**

**BUS-83**


BUS-01 2001 Busard, Hubertus L. L. (Ed.): *Johannes de Tinemme’s redaction of Euclid’s Elements, the so-called Adelard III version*, Steiner, Stuttgart (Germany), 2 vol., 632 p.


BUI-99 1999 Buikema-Draisma, Frouke: O que significa 3 x 4? O uso de duas definições de multiplicação no ensino em Moçambique’ [What is the meaning of 3 x 4? The use of two definitions of multiplication in Mozambican schools], in, *Actas do ProfMat 99*, Associação de Professores de Matemática, Lisbon (Portugal), 195–213.


BUR-52 1952 Burssens, Amaat: Les numéraux en Amashi (Kivu) [The numerals in Amashi], *Kongo-Overze*, Antwerpen (Belgium), Vol. 43, No. 1, 66-76 (in French).
Mathematics in African History and Cultures

Lists the numerals in Amashi, the language of the Abashi (Kivu, Congo / Zaire) and discusses grammatical aspects.

BUR-54

BURS-58

Presents brief information on the numeration systems among the Ngbandi, Ngbaka [‘7’=‘6+1’; ‘9’=‘5+4’], Mbandja [‘7’=‘6+1’; ‘9’=‘8+1’] and Ngombe (Congo / Zaire).

BURT-45

BYN-67

Presents a comparative linguistic study of the construction of the words for ordinal numbers in Bantu languages. Includes maps on the geographical distribution of the four basic methods of construction analyzed by the author.
CAM-76

Describes an experimental liberal arts mathematics course (St. Olaf College, Northfield, USA) on African mathematics: consideration of numeration systems, geometry in art and architecture, and mathematical games; together with an analysis of important concepts of ‘western’ mathematics they suggest.

CAP-83

Contributes towards a terminology for the teaching of arithmetic in African languages. Discusses the expressions used for numbers and operations in two Sara languages from Chad: Ngambay and Mango.

CAP-86

CAP-87
1987 Jean-Pierre Caprile: Numérations orales et enseignement des mathématiques en Afrique [Oral numeration and the teaching of mathematics in Africa], *LENGAS, revue de sociolinguistique*, Université Paul Valéry, Montpellier (France), No. 21, 143-162 (in French).
Mathematics in African History and Cultures

Paper presented at a session organized by the African Bureau of Educational Sciences in Kisangani (Congo / Zaire) in December 1984. It gives some information on systems of numeration in Africa (Sara-Ngambay in Chad; Birom in Nigeria; Banda in Central-Africa) and outside Africa.

CAR-70

The author compiled information on traditional ways of measuring time, distance, weight, and volume in Zambia. The information was collected by “using University students who sought out the oldest people of their villages to find out how these things were done before the European types of measurement replaced the African methods.”

CARR-48

CAS-70

Lists references up to 1967 on science and mathematics education in the English-speaking countries of East, West, Central and Southern Africa.

CASM-75

Report of a seminar organized by the Commonwealth Association for Science and Mathematics Education (CASME), held in Accra (Ghana). It includes among other papers TAI-75 and a reproduction of MMA-74.
CASS-03

CAV-92

The author analyses Egyptian calculations, both as concrete calculations concerning daily life and as an art of the abstract calculation. He concludes from this philological and mathematical analysis that, contrary to what assert other historians of science, that the calculators of this civilization do not consider ‘quantième’ as ‘part of the unity’ but rather as ‘part of a collection.’

CAV-94

This book is the up-dated version of the first volume of the thesis defended by Caveing in 1977, entitled ‘The constitution of the mathematical type of the ideality in Greek thinking’. The first part of Volume 1 is dedicated to the study of Babylonian mathematical texts (19-236). The second part deals with the art of calculation of the ancient Egyptians (237-404).

Review: VIT-99b

CEN-63

Includes games of Katanga (Shaba): sand drawings, games of chance, counting chants, *kisolo* (mancala) game, string figures, memory games.
Mathematics in African History and Cultures

1994  Chabert, Jean-Luc et al.: *Histoire d’algorithmes du caillou à la puce* [History of algorithms from the pebble to the flea], Éditions Belin, Paris (France), 591 p. (in French).

Collective work of seven authors (among them Ahmed Djebbar) on the history of algorithms, including analyses, comments and (translations of) original texts. The chapters and those sections directly related to the history of mathematics in Africa are the following:

1. Algorithms of arithmetical operations (11-58)
   * Egyptian arithmetical algorithms: Rhind Papyrus (1650 BC) (20-25)
   * Optimization of calculations: *Hawî l-lubâb* (1437) of Ibn al-Majdî (Egyptian mathematician and astronomer) (34-36)

2. Magical squares (59-94)
   * A plotting procedure: Ibn Qunfudh (Maghreb, 14th century), *The unveiling of the operations of calculation* (69-74)

3. Around the methods of false position (95-128)
   * Egypt: Problem 26 of the Rhind Papyrus (101-104)
   * The *Talkhîs* of Ibn al-Bannâ (Maghreb, 13th century) (116-118)

4. Around Euclid’s algorithm (129-158)

5. From circle measurement to π (159-192)


7. Solution of equations by successive approximations (227-262)
   * Heron of Alexandria, *Metrica* (1st century) (231-232)
   * Theon of Alexandria, Comments on the *Almagest* (4th century) (232-234)

8. Algorithms of number theory (271-318)
   * Diophantus of Alexandria, The six arithmetic books (about 250) (290-311)

9. Solution of systems of linear equations (319-354)
10. Tables and interpolation (355-392)

11. Approximate quadratures (393-414)
12. Approximate solutions of differential equations (415-448)
13. Approximation of functions (449-476)
14. Acceleration of convergence (477-536)
Biographical notes (540-576), with information on the following mathematicians who were Africans or worked (some time) in Africa: Abû Kâmil, Archimedes, Diophantus, Eratosthenes, Euclid, Fibonacci, Heron, Hypathia, Ibn al-Bannâ, Ibn al-Haytham, Ibn al-Majdî, Ibn Qunfudh, Ptolemy, Theon.

CHAC-27
1927 Chace, Arnold B.: The Rhind mathematical papyrus: British museum 10057 and 10058, Mathematical Association of America, Oberlin, Ohio (USA), 109 pl. [Reprint: National Council of Teachers of Mathematics, Reston VA (USA), 1979, 140 p.]

CHAK-94
1994 Chakalisa, Paul: Relationships of student gender, teacher experience and setting to students achievement and attitudes toward mathematics in Botswana junior secondary schools, doctoral thesis, Ohio University, Athens (USA).

CHAM-02

CHES-05
2005 Che, Stacy Megan: Cameroonian teachers’ perceptions of culture, education, and mathematics, doctoral thesis, University of Oklahoma (USA).

CHEM-02
Analyses “certain asymmetrical rhythmic structures appearing in the music of the culture of the Aka Pygmies of Central Africa. Complex mathematical patterns have been carefully woven into this music. Since these patterns are imperceptible to the listener, the author concludes that they must have been incorporated into the music as a result of mathematical rather than aesthetic concerns.”
Mathematics in African History and Cultures

CHE-99
1999 Cherinda, Marcos: *Weaving geometric shapes: exploring the weaving board*, Universidade Pedagógica, Maputo (Mozambique), 30 p.

Booklet for children on exploring geometrical designs, using a weaving board, inspired by African basket and mat weaving.

CHE-02

CHET-91

CHI-74


CHIO-95

CHRI-03
CHR-91

“The author suggests a conjecture about the existence of a lost theoretical treatise of Diophantus, entitled *Teaching of the Elements of Arithmetic*. His claims are based on a scholium of an anonymous Byzantine commentator.”

CLA-89

CLE-98

“This article is concerned with language use in mathematics lessons in settings where the language of instruction is a second language for all or most of the learners. Four lessons taken from primary schools in Montreal and in Zimbabwe are compared, illustrating ways in which the teachers in each setting couple development of the second language with teaching of the subject content. By doing so, we believe that instruction is effective in helping children to make the shift from the primary school emphasis on computing numbers to the secondary level emphasis on solving problems; in the long term children are also better prepared for the language-related demands of higher education.”

COLE-74

Examines cognitive behavior involved in making quantitative judgments among the Kpelle people of Liberia. Deals with subjects such as geometric concepts, disjunction and conjunction, and estimates of volume, length, time and number.
The gradual merging of algebra, arithmetic and geometry into a unified subject in schools in the UK is taken as the basis for recommending a similar change to take place in the British colonies of West Africa.

Analyses the way the Guidar in North-Cameroon give names to their children. The first name indicates the order in which the mother gave birth (and also the sex in the case of the first four children); the second name is the name-number of the father of the child. E.g. the first of an individual called Tizi Dawaï expresses that he is a boy and the first child of his mother; his surname indicates that his father is the seventh child of his respective mother.


Couchoud, Sylvia: Recherche sur les connaissances mathématiques de l’Egypte pharaonique [Research on mathematical knowledge in pharaonic Egypt], doctoral thesis,
Couchoud’s thesis on mathematical knowledge in Pharaonic Egypt, deals with 1) arithmetical operations and the notion of fraction, including a study of ‘red auxiliaries’ (14-39); 2) geometry (metrology, plane figures and solids, \(nbt\)-notion) (40-188); 3) procedures which are equivalent to equations and series (189-330); 4) solutions of concrete problems (distribution of daily food rations, production of sandals, delivery of wood, etc.) (331-371).

COU-86

In the problem, the scribe calculates two sums of natural numbers. The first is the sum of the first ten natural numbers. According to R. A. Parker, the second should be the sum of the first ten square numbers. But the sum given by the scribe is 220 and not 385. The author of the paper thinks that in fact the scribe wanted to calculate the following sum: \(S_1 + S_2 + ... + S_{10}\), with: \(S_1 = 1\), \(S_2 = 1+2\), \(S_3 = 1+2+3\), \(...\), \(S_{10} = 1+2+...10\), that is indeed equal to 220. If this interpretation is exact, then “only Egypt [among the peoples of Antiquity] could give evidence, by means of the formulation of problem number 53 of the Demotic papyrus B.M.10520 and the solution that may have obtained, of this very advanced knowledge.”

CRO-71

Uses a group theoretic analysis of repeated patterns to study strip and plane patterns on Bakuba raffia cloths and carved wooden boxes and cups (Congo / Zaire). All seven possible strip patterns and (at least) 12 plane patterns occur in Bakuba art.

CRO-73
Presents examples of the geometric analysis of the symmetries of repeated patterns as appearing in Bakuba art (Congo / Zaire), Benin bronzes (Benin, Nigeria), Yoruba *adire* cloth (Nigeria).

**CRO-75a**


Investigates the repeated patterns found in the art from Benin, classifying them on the basis of the 24 plane crystallographic group. All 7 possible strip patterns and 12 of the 17 frieze patterns occur. A catalog is given with most of the strip patterns the author has found in Benin art, along with one example of each of the 12 plan patterns that occur.

**CRO-75b**


**CRO-82a**

1982a Crowe, Donald: The geometry of African art III. The smoking pipes of Begho, in: C. Davis, B. Grünbaum, F. Sherk (Eds.), *The geometric vein, the Coxeter Festschrift*, Springer Verlag, New York (USA), 177-189.

Applies the symmetry classification scheme for repeated patterns to the analysis of the decorated pipes excavated from the K2 site of the Kramo quarter of Begho (Ghana). All seven one-dimensional types appear, and seven of the seventeen possible two-dimensional patterns were found on Begho K2 pipes.

**CRO-82b**


Investigates the repeated patterns found in African art, classifying them on the basis of the 24 plane crystallographic groups. Of these, seven admit translations in only one direction (the corresponding patterns are called strip patterns), while the remaining 17 admit two
independent translations (so-called plane patterns). Presents examples from Cameroon, Congo / Zaire, Ghana, and Nigeria.

CRO-01

CRO-05

“Two tabletops carved by a Bakuba wood-carver reveal a surprising duality. Although the carvings at first glance appear completely different, closer attention shows that the carved portion of each is exactly the uncarved portion of the other. Hence, in a certain sense, they have exactly the same symmetries. We discuss the cultural insights suggested and supported by this observation.” [DR Congo]

CROZ-96

CUO-00

Chapter 1 examines the place that have mathematicians or those that have to do with mathematics (artisans, jurists, astrologers, ...). The following three chapters are dedicated to the Books III, IV, V, VIII or to the specific questions posed in Pappus’ *Collection* (classifications of problems, regular polyhedra, geometry of curves, isoperimetric figures, mechanical questions...). The fifth and last chapter tries to determine Pappus’ motivations and intentions, his use of the tradition
and his relationship with history and his predecessors. This approach of Pappus is innovative as such and constitutes one of the strong points of the work.

Shape of a plaited nonahedron (Mozambique) (cf. GER-05c)
DAM-81

Original version of DAM-96.

DAM-96

Translation of DAM-81. Includes sections on the ‘Structural characteristics of Ancient Egyptian Arithmetic’ (176-188) and ‘The means of calculation in Ancient Egypt’ (188-199).

DAMB-98

DAR-03

DAV-88

Describes the three-in-a-row game from Somalia, called shax, indicating the differences with the morabaraba game from Lesotho.
DEA-92
Describes the life, times, and work of Hypatia of Alexandria (370-415 AD).

DEA-94
Evaluates the sources of knowledge about Hypatia of Alexandria (around 370-415 AD), and describes what is known of her mathematical activities.

DEA-95
Describes the primary sources for the life, times, and work of Hypatia of Alexandria.

DEA-96
This review of DZI-95 welcomes Dzielska’s book: “We have waited over two centuries since the last book-length biography of Hypatia of Alexandria was published in English” (p. 83), analyses Dzielska’s reconstruction of Hypatia’s philosophical ideas, and criticizes the treatment of Hypatia’s mathematics.

DEL-28
Analyses the most frequent structures of number words in African languages: ‘6’ = ‘5+1’ = ‘+1’ = ‘2x3’; ‘7’ = ‘5+2’ = ‘2nd 6’; ‘8’ = ‘5+3’ = ‘+3’ = ‘2x4’ = ‘4+4’; ‘9’ = ‘5+4’ = ’10 – 1’ = ‘missing 1’

DELE-81

DER-72

DER-76

DEY-84

DEY-94

DHO-87

This book is addressed to high school pupils and their teachers. It contains extracts of texts by mathematicians throughout history. The extracts are accompanied by commentaries, and are grouped into six chapters: Object and Utility of Mathematics, Arithmetic and Number
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Theory, Algebra, Calculus, Probability, Geometry. University lecturers and high school teachers have worked together on the conception of this book. Ahmed Djebbar has contributed with the topics on Arabic mathematics.

DIAG-80

Argues that a teacher of mathematics should start with concrete situations drawn from the socio-cultural context of the child to give it the opportunity to discover structures. The mother tongue is the language to think of these structures (Senegal).

DIA-82

Paper on doing mathematics in the Wolof language (Senegal).

DIAL-79
1979 Diallo, Fatoumata Câmara: Recherche des conditions de possibilité d’une didactique mathématique au Mali, doctoral thesis, Université de Bordeaux 2 (France) (in French).

DIO-59

Translated for the first time from Greek into French by Paul Ver Eecke.

DIO-74
1974 Diophantus of Alexandria: Diophanti Alexandrini Opera omnia cum graecis commentariis [The complete works of Diophantus of Alexandria] (reprint of the 1893-1895 edition by Paul
This study is based on a series of unpublished manuscripts and has three chapters. The first deals with different classifications of equations of degree inferior or equal to two, the role of geometry in the study of these equations and the contribution of the Maghrebians in this domain. The second chapter deals with the arithmetical and algebraic symbolism that was used in the Maghreb from the 12th century on and that would be brought to Egypt from the 14th century on. The third chapter reveals and gives an exposition – for the first time – of certain aspects of the contribution to combinatorics by mathematicians from the Maghreb.
DJE-84b
1984b Djebbar, Ahmed: Les scientifiques arabes face à leur patrimoine [Arab scientists facing their heritage], *Revue de la Documentation française, Maghreb-Machrek*, Paris (France), No. 105, 48-64 (in French).

DJE-85a

Contains a commentary and a translation of section XI of ‘Fiqh al-Hisab’, a manual written by Ibn Munčim (Maghreb) between 1207 and 1212. On the basis of some linguistic problems (number of Arabic words of given length etc.), Ibn Munčim develops his combinatorics. He presents an arithmetic triangle (the so-called Pascal’s triangle) and deduces the equivalents of formulas like

\[
\begin{align*}
C_{p-1}^n C_p^n & = C_{n-1}^{p-1} + C_{n-2}^{p-1} + \ldots + C_{p-1}^{p-1}, \\
P_n &= n!, \\
p^{k_1 \ldots k_r} &= \frac{P_n}{p^{k_1} \ldots p^{k_r}},
\end{align*}
\]

centuries before Cardano, Tartaglia, Mersenne, Frenicle, etc., in Europe.
Detail of Ibn Mun'im’s manuscript with his arithmetic triangle four centuries before Pascal (1623-1662)

DJE-85b

DJE-86a
This paper presents the economic, political, cultural and ideological context in which the mathematical activities in the Arab-Islamic civilization were born and developed. It deals equally with the internal and external factors that could explain the retardation, from the 14th century onwards, of the scientific activities of this civilization.

DJE-86b

Text of a public lecture given in Strasbourg in 1986 on the main directions in algebra in the Arabic mathematical tradition from the 9th to the 15th century.

DJE-87a

DJE-87b
1987b Djebbar, Ahmed: L’analyse combinatoire au Maghreb entre le XIIe et le XIVe siècle [Combinatorics in the maghreb between the 12th and the 14th century], in: Dhombres, Jean (Ed.), Cahiers d'Histoire et de Philosophie des Sciences, Nouvelle série, Paris (France), No. 20, 232-239 (in French).

DJE-87c

DJE-88a
This paper discusses the origin, the beginnings and the development of algebra in the Muslim East from the 8th century on. Information is given on the contributions of al-Khwârizmî (d. 850), Abû Kâmil (d. 930), al-Karađî (d. 1029), as-Samaw‘al (d. 1175), al-Khayyâm (d. 1131) and Sharaf ad-Dîn at-Tûsî (d.1213) as well as on the contribution of lesser known researchers like Sinân Ibn al-Fath (10th C.), who have participated in the development of this discipline.

DJE-88b
1988b Djebbar, Ahmed: Mathématiques et linguistique dans le Moyen Age arabe [Mathematics and linguistics in the Arab Middle ages], in: Résumé des communications du Colloque Sciences au Moyen Age (22-23 Avril 1988), Université d’Orléans, Orléans (France), 21-24 (in French).

This communication is a summary of various studies by the author (published between 1981 and 1985), that concern the combinatorial practice in Arabic linguistics, music and lexicography and also the history of the progressive mathematisation of this combinatorial practice in the East and in the Maghreb (between the 9th and the 14th century).

DJE-88c
1988c Djebbar, Ahmed: Le contenu de l’enseignement mathématique dans le nord de l’Afrique, au moyen âge et son rôle dans l’enseignement actuel [The contents of mathematics teaching in North Africa during the Middle Ages and its role in present day teaching], École Normale Supérieure, Algiers (Algeria), 16 p. (in French).

After a short description of mathematical activity in North Africa during the Middle Ages, the author describes the mathematical contents taught at that time (decimal system, six arithmetical operations, polynomials and the algebraic and geometric solution of polynomial equations). In the last part he underlines the cultural value of this rich heritage of medieval mathematics for education today in North Africa.
DJE-89a

DJE-89b

Gives a brief overview of the contents of mathematics teaching in North Africa in the Middle ages and demonstrates, using as examples the Arabic-speaking regions of Africa, the possibilities which are offered by the mathematical heritage of these regions to enrich the pedagogy of teaching mathematics today.

DJE-90a

In the first part of this paper the author presents the different known aspects of combinatorial practices in various domains of medieval Arabic culture and science (linguistics, lexicography, grammar, poetry, astronomy, algebra). The second part is dedicated to the mathematization of these combinatorial practices and to the contribution of two Maghrebian scientists – Ibn Mun‘im (d. 1228) and Ibn al-Bannâ (d. 1321) – to this mathematisation: elaboration of definitions, propositions and demonstrations of combinatorial nature and the introduction of combinatorial techniques in different domains, both mathematical and non-mathematical.

DJE-90b

This article is dedicated to the Maghrebian scientist (of Andalusian origin) ‘Ali al-Qalasâdî (1412-1486) who has been the most important
A mathematician in the Maghreb during the 15th century. The paper contains a detailed biography of this scientist and an exposition of the contents of his mathematical works on arithmetic, algebra and also on the use of arithmetical techniques in the solution of heritage problems.

DJE-90c
1990c Djebbar, Ahmed: *Le traitement des fractions dans la tradition mathématique médiévale du Maghreb* [The treatment of fractions in the medieval mathematical tradition of the Maghreb], Université de Paris-Sud, Pré-publications Mathématiques d’Orsay, Paris (France), No. 90-04, 30 p. (in French).

The author exposes first the essential aspects of the theory of fractions in the Arabic mathematical tradition of the East and then, on the basis of a study of manuscripts from the 12th to the 16th century, he analyses the transmission of the concepts and techniques of the fractions from the East to the West and he exposes new elements that concern the practices of calculation with fractions as encountered in the mathematical works of the Maghreb.

DJE-90d

The dissertation has the following chapters:
1. General Introduction
2. Historical introduction: the context of the arrival and development of mathematical activities in the Maghreb
3. Mathematical education and research in the Maghreb during the 13th and 14th centuries
4. Combinatorics in the Maghreb: the example of Ibn Mun'im (12th –13th centuries)
5. Some remarks on the relationship between Arabic philosophy and mathematics
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6. Two little known mathematicians from 11\textsuperscript{th} century Spain: al-Mu’\textquotesingle taman and Ibn Sayyid
7. The mathematical contribution of al-Mu’\textquotesingle taman and his influence on the Maghreb
8. The treatment of fractions in the Arabic mathematical tradition of the Maghreb
9. Abû Bakr Ibn Bâjja and the mathematics of his time
10. Discovery of a mathematical manuscript of al-Hassâr (12\textsuperscript{th} century): Book I of al-Kâmil
11. Figurate numbers in the mathematical tradition in Andalusia and in the Maghreb
12. Some new elements on Arabic mathematical activity in the oriental Maghreb (9\textsuperscript{th}–16\textsuperscript{th} c.)
13. Some aspects of algebra in the Arabic mathematical tradition
14. The algebra book of Ibn al-Bannâ
   * Introduction and mathematical analysis
   * Translation into French
   * Arabic text

DJE-90e

DJE-91a
1991a Djebbar, Ahmed: Mathématique et linguistique dans le Moyen-\textsuperspace{\textsuperscript{a}ge arabe. L’exemple de l’analyse combinatoire au Maghreb [Mathematics and linguistics in the Arab Middle Ages. The example of combinatorics in the Maghreb] in: Actes du Colloque “Le Moyen-\textsuperscript{a}ge et Sciences” (Orléans, 22-23 April 1988) [Colloquium on The Middle Ages and Science], Kincksieck, Paris (France), 15-29 (in French).

DJE-91b
1991b Djebbar, Ahmed: Scientific activities in Marrakech during the 12\textsuperscript{th} – 13\textsuperscript{th} century, Revue Arabe des Technologies, Paris (France), No. 15, 13-25 (in Arabic).
DJE-92a

Two of the three mathematicians presented in this paper, al-Mu’taman (d. 1085) and Ibn Sayyid (11th - 12th century), have written mathematical texts that have been used in the Maghreb during the 12th and 13th century. The third scholar, Ibn Bâjja (d. 1138), has lived the last part of his life in the Maghreb.

DJE-92b

See the summary in: DJE-90c.

DJE-95a

Overview of mathematical activities in medieval Maghreb. See DJE-95b.

DJE-95b

Translation of DJE-95a.

DJE-96a
1996a Djebbar, Ahmed: On mathematical activities in North Africa since the 9th Century, *International Study Group on the
Euclid’s *Elements* were probably the most studied and most commented text by Arab mathematicians in the period between the end of the 8th century and the beginning of the 19th century. Several Arabic versions of the *Elements* were used. The paper presents new information concerning terminology and certain variants found by the author and relative to the transmission of the *Elements* to and their use in the Muslim West.

DJE-97a

The author presents a “14th-century manuscript that has not been studied before. It contains a complete redaction of the *Kitāb al-istikmāl* by the Andalusian mathematician, al-Mu’taman ibn Hûd (11th century), and informs us about the missing pieces of al-Mu’taman’s book and about the content of his initial project that had never been completed.”

DJE-97b
1997b Djebbar, Ahmed: *Les activités mathématiques dans le Maghreb Central* [Mathematical activities in the Central Maghreb], Université de Paris-Sud, Paris (France), Preprint No. 97, 43 p. (in French).
The article describes the conditions under which, between the 9th and the 15th century, emerged and developed a series of mathematical activities in some cities in the Central Maghreb. The description includes the links that were woven between these cities and other scientific centers in the west Mediterranean that exercised mutual influence and stimulated the circulation of ideas and men. The study presents also some mathematicians from this region of the Maghreb, by specifying their various known contributions, both with respect to their publications as to their scientific teaching.

DJE-98

The article presents first the context of the development of geometrical reasoning in the Arabic scientific tradition, then it evokes the pre-Islamic sources of demonstration. In the third part, it explains the status of the various types of geometrical justification. The fourth part treats geometrical reasoning as object of study by mathematicians. The last part discusses various types of geometrical reasoning in Arabic philosophic and mathematical writings.

DJE-00a

The paper analyses certain contributions made in Andalusia and the Maghreb to the theme of figurate numbers. These numbers are a geometrical representation of numbers and had been created by the Pythagorean School. The oldest known study of these numbers is found in the Introduction to Arithmetic by Nicomachus. An Arabic translation of this work circulated in Andalusia and in the Maghreb from the 10th century onwards.

DJE-00b
The paper presents some unpublished information on the mathematical activities in the region of the Maghreb that, from the 16th century onwards, was under the political authority of the Ottoman power of Istanbul. A comparison is made between these activities and those in the Western Maghreb, which were autonomous.

DJE-00c

The paper presents little known element about the recreational and game aspects of Arab mathematics from the East and from the Maghreb.

DJE-00d

Study of the different types of circulation of mathematical knowledge since the 12th century, inside the Muslim empire, between the East and the West, and outside this empire to Latin Europe.

DJE-00e

Study of the different interventions of the imagination among the mathematicians of the Islamic countries, both in their scientific practice and their discourse.
DJE-01a
2001a Djebbar, Ahmed; Rommevaux, Sabine & Vitrac, Bernard: Remarques sur l’histoire du texte des Éléments d’Euclide [Remarks on the history of the text of Euclid’s Elements], Archives for the History of Sciences, Berlin (Germany), No. 55, 221-295.

A comparative study of certain aspects of the contents of the three great traditions of Euclid’s Elements, those of ancient Greece, of the Arab translators and commentators and of the medieval Latin translators and commentators.

DJE-01b

An analysis of the different transaction problems and the solution procedures included in the known Arab mathematical manuals that were published between the 9th and the 14th century.

DJE-01c

Summary of the most significant developments in algebra during the Arab phase, that is between the 9th and the 15th century. An important place is given to algebraic activities in Andalusia and in the Maghreb.

DJE-01d
2001d Djebbar, Ahmed: Las Matemáticas árabes y su papel en el desarrollo de la tradición científica europea [Arab mathematics and its role in the development of the European scientific tradition], in: Galileo y la gestación de la ciencia
Mathematics in African History and Cultures

*moderna*, (La Laguna and Las Palmas de Gran Canaria, October 1999 - May 2000), Fundación Canaria Orotava de Historia de la Ciencia, Las Palmas (Canarian Islands, Spain), 23-34 (in Spanish).

Paper presented at the Universities of La Laguna and Las Palmas in which information is given about the role of Andalusia in the development of certain mathematical activities and their diffusion to medieval Europe.

DJE-01e

The book constitutes a bio-bibliographical essay on the most important mathematician from the Maghreb of the 14th century. It is based essentially on the handwritten sources from the Maghreb, which the two authors have studied during this last decade. The book contains a detailed biography of the mathematician, reconstituted from testimonies both from historians and from mathematicians who commented on some of his works. It also contains the complete list of Ibn al-Bannâ’s writings, reconstituted from information supplied by his commentators, as well as with references from the libraries containing these manuscripts.

DJE-01f

The contents of this book of popularization are presented in 8 chapters in the form of interviews. The first three treat the emergence and development of the Moslem Empire, the place of the science in the Arab–Moslem societies of the 9th to the 15th century and the role of the ancient heritage in the development of these sciences. The five remaining chapters are dedicated to the presentation of the most important scientific disciplines that were practiced in this civilization: astronomy, mathematics, physics, earth and life sciences, chemistry.
DJE-02a

Paper presented at a colloquium organised by the ‘Académie Royale des Sciences d’Outre Mer’ & UNESCO (Brussels, 5-6 April 2001). Partial analysis and reflection about the relationships between two types of knowledge that are often separated, in the discourse on science, but that have known important interactions. The question is illustrated by the study of the complex relationships that existed between the oral and written transmission and the theoretic and practic aspects of scientific activity in the countries of the Islam.

DJE-02b

This is the French translation of an important book of al-Khayam that includes three chapters: the first contains an attempt of demonstration of the postulate of parallels. The second presents new definitions of the equality and the inequality of two proportions considered better than those given by Euclid in Book V of the *Elements*. The third chapter deals with the composition of the proportions, which was an operation very useful for the astronomers.

DJE-02c
Mathematics in African History and Cultures

Paper included in the Proceedings of the Colloquium on “2000 Years Transmission of Mathematical Ideas: Exchange and Influence from Late Babylonian Mathematics to Early Renaissance Science” (Bellagio, Italy, May 8-12, 2000).

DJE-03a

Paper presented at the Dibner Institute Conference on “New Perspectives on Science in Medieval Islam” (Boston, November 6-8, 1998).

DJE-03b

DJE-03c

DJE-03d
DJE-03e

DJE-03f

DJE-03g
2003g Djebbar, Ahmed: Nasîr ad-Dîn at-Tûsî, un savant polygraphe du XIIIe siècle [Nasîr ad-Dîn at-Tûsî, a polygraphic scholar of the 13th century], Revue Farhang, Teheran (Iran), 159-181 (in French).

DJE-03h

DJE-04a
DJE-04b
2004b Djebbar, Ahmed: Du nombre pensé à la pensée du nombre: quelques aspects de la pratique arithmétique arabe et de ses prolongements en Andalus et au Maghreb [From the thought number to the thinking of number: Some aspects of the Arab arithmetical practice and its continuation in Andalusia and in the Maghreb], in: C. Alvarez, J. Dhombres & J.-C. Pont (Eds.), *Actes de la “Rencontre Internationale de Peyresc sur la pensée numérique”* (Peyresc, 7-10 September 1999), *Sciences et Techniques en Perspective*, Brepols (Belgium), Second Series, Vol. 8, No. 1, 303-322 (in French).

The article presents what is known about the arithmetical practices from the Islamic East that have circulated in Andalusia and in the Maghreb and that were continued in both regions.

DJE-04c
2004 Djebbar, Ahmed: Les sciences autour de la Méditerranée jusqu’à la guerre de Cent ans [Sciences around the Mediterranean until the 100-year war], *Cahiers art et science*, Université de Bordeaux 1 (France), numéro spécial 8, 75-90 (in French).

DJE-05a

Presents an overview of the genesis of algebra in Arab culture. The introduction explains the context in which the Arab algebraic tradition emerged (p. 11-18). The following chapters constitute the first part entitled “Arab algebra in the Muslim East”: “The first steps of algebra as a discipline” (p. 19-48), “The Arab algebraic practices in the 9th century” (p. 49-51), “The contributions of the 10th century” (p. 51-54), “The new orientations of algebra in the 11th and 12th centuries (p. 54-70), and “The algebraic practices in the east after the 12th century” (p. 70-72). The second part “Arab algebra in the Muslim West” is composed of two chapters: “The beginnings of algebra in the Muslim West (p. 74-78) and “The algebraic practices through existing works” (p. 78-104). The third part is about Arab algebra in Europe (p. 105-116). The first appendix (p. 123-145) presents short biographies of
mathematicians, including the following North Africans Abu Kamil (d. 930), Abu Bakr al-Hassar (12th century), Samaw’al (d. 1175), Ibn al-Yasamin (d. 1204), Ibn Rashiq (c. 1275), Ibn al-Banna (1256-1321), Uqhani (1320-1408), Ibn Qunfudh (1339-1407), Ibn al-Ha’im (1352-1412), Ibn Haydur (d. 1413), Ibn al-Majdi (1365-1447), Qatrawani (15th century), Sibt al-Maradini (1423-1506), Ibn Ghazi (1437-1513), and of mathematicians born outside Africa but who lived for many years in North Africa, like Ibn al-Haytham (965-1041), Al-Qurashi (d. 1184), and Al-Qalasadi (1412-1485). Appendix 2 (p. 147-180) presents some types of algebraic problems. Appendix 3 (p. 181-184) presents testimonies on problems not solved by mathematicians from the countries of the Islam. Appendix 4 (p. 185-190) presents a lexicon of technical terms, followed by the general bibliography in appendix 5 (p. 191-206) and an index.

DJE-05b  

Gives an overview of the development of the scientific production and practices realized in the Arabic language from the 8th to the 16th century. The chapters deal with mathematics, astronomy, geography, medicine, chemistry, mechanics and the appropriation of the Arab sciences in Europe.

DJE-05c  

DJE-05d  
DJE-05e

DJE-05f

DJE-05g

DOU-84

Studies mathematical aspects of traditional games of Ivory Coast / Côte d’Ivoire:
1. Verbal games: memory and counting games (S. Doumbia, J. Garin & T. Nguyen);
2. Simple calculation games: Lokoto and Abikou (T. Nguyen);
3. Board games: Awalé (S.Doumbia), Tiouk-Tiouk (F. Carpentier & T. Nguyen), Dili (T. Nguyen), Kpanê and Kro Konono Kpanê (S. Doumbia & T.Nguyen);
4. Gambling games: Kélio (F. Carpentier & S. Doumbia);
5. Games of chance: weight games (T. Nguyen), Nigbé, a cowry game (S. Doumbia).

DOU-89a
DOU-89b

The Mathematical Research Institute of Abidjan (IRMA, Ivory Coast) classified the traditional games of the country into five categories: verbal games, games of memory, calculating games, games on a checkerboard and games of chance. IRMA studies the mathematics involved in these games and looks for ways to integrate this mathematics into the curriculum. As an illustration the knowledge of probabilities in the *Nigbe Alladian* game is described.

DOU-91


DOU-92

Describes games with cowrie shells: *nigbé* (as played by the Alladian, Côte d’Ivoire), *nigbé* (as played by the Godié, Côte d’Ivoire), *ediprè* (Ebrié, Côte d’Ivoire), *tiatia* (Bambara, Mali), *koué* (Gourounsis, Burkina Faso), *kar* (Dogon, Mali), *tcha-tcha djirokimé* (Benin), *kô* (Wès, Côte d’Ivoire), and equivalent games of chance like *nama* and *piaf* (Mali), *horbido* (Lébous, Senegal), *sonrai* and *bozo* (Mali), *paradis* (Mali), *abbia* (Gabon, Cameroon). Also analyses the mathematical aspects of these games and shows how the rules of some of the games like *nigbé* (Alladian) give all participants equal opportunity (chance) to win, i.e. they reflect an empirical knowledge of the involved probabilities. The book presents computer simulations of some games and argues for the uses of these games in mathematics education.
DOU-94a
1994  Doumbia, Salimata: Dossier jeux, mathématiques et sociétés
[File on games, mathematics and societies], *Plot*, Orléans
(France), Vol. 69, 1-31 (in French).
Contains an introduction on ‘Mathematics in the African socio-cultural
environment’ with information about and examples from the traveling
exhibition ‘Games, Mathematics and Societies.’

DOU-94b
1994b Doumbia, Salimata & N’guessan, D.: Les jeux de cauris
[Cowrie shells games], in TOU-94 (in French).

DOU-95
1995  Doumbia, Salimata: L’expérience en Côte d’Ivoire de l’étude
de jeux traditionnels africains et de leur mathématisation [The
experience of Côte d’Ivoire in the study of traditional African
games and their mathematization], in: IREM-95, 549-555 (in
French).

DOU-97
1997  Doumbia, Salimata: Maths et Cultures: Pythagore en Afrique
[Mathematics and cultures: Pythagoras in Africa], *Bulletin sur
l’Harmonisation des Programmes de mathématiques des pays
francophones d’Afrique et de l’Océan Indien*, Abidjan (Côte
d’Ivoire), Vol. 3, 6-11 (in French).
Gives examples of Pythagoric figurate numbers in West Africa and
presents some ideas of Gerdes’ book *African Pythagoras* on African
crafts and the Pythagorean theorem.

DRAC-50
1950  Drachmann, A. G.: Heron and Ptolemaios, *Centaurus*,
Copenhagen (Denmark), Vol. 1, 117-131 (in German).

DRA-86
1986  Draisima, Jan; Tembe, Albasine; Kuijper; Jelske & Neeleman,
Wim: Mathematics Education in Mozambique, in: *Proceedings
of the 4th Symposium of the Southern Africa Mathematical
Sciences Association (SAMSA)*, University of Swaziland,
Kwaluseni (Swaziland), 56-96.
Presents an overview of the development of mathematics education in Mozambique.

DRA-93
1993 Draisma, Jan: How to handle, in (teacher) education, the theorem $8 + 5 = 13$?, in: Julie, Cyril; Angelis, Desi & Davis, Zain (Eds.), Political Dimensions of Mathematics Education 2. Curriculum reconstruction for society in transition, Maskew Miller Longman, Cape Town (South Africa), 196 – 207

DRA-96

Paper gives information on written subtraction algorithms used in Mozambican schools and on how primary teachers do subtraction and interpret the procedures.

DRA-99
1999 Draisma, Jan: Numeração falada e gestual como recursos na aprendizagem inicial da matemática [Spoken and gesture numeration as resources for the early learning of mathematics], in: Actas do ProfMat 99, Associação de Professores de Matemática, Lisbon (Portugal), 253-269 (in Portuguese).

DRA-00

Report of an experimental program of gesture and oral computation realized in a semi-rural primary school in the centre of Mozambique. Portuguese, Ndau, Sena and Chuwabo are the four languages spoken by the pupils. Modified number words based on ten and five were introduced in Portuguese, Ndau and Sena, in order to give them the
same regular structure as they have in Chuwabo and have these correspond directly to gesture computation.

DRA-06a

DRA-06b

DUR-94
1994 Duranti, Gian Carlo: *Codici del Pentateuco e matematica egizio-platonica* [Codex of the Pentateuch and Platonic-Egyptian mathematics], L’Arcipelago, Genova (Italy), 68 p. (in Italian).

DUV-99

DZI-95
Translation by F. Lyra of an unpublished manuscript in Polish Hypatia z Aleksandrii. Contents the following chapters: The literary legend of Hypatia; Hypatia and her circle; The life and death of Hypatia.
Review: DEA-96.
EBE-92
1992  Ebeid, William: *Research in Mathematics Education in Egypt*, Aïn Shams University, Cairo (Egypt), 8 p. (mimeo)


EGL-89

A 2-dimensional Fourier transform is used to show fractal structure in an aerial photo of a Songay village in Mali.

EGL-94

Discusses self-similarity in altar, house, and village structures among the Jola in the Lower Casamance region in southern Senegal.

EGL-95a

Short note that analyses the presence of a scaling series of hexagons in a mask from the Bassari (eastern Senegal) and compares it with the use of the number six in other contexts (time reckoning, string tallies, divination).

EGL-95b
The author reviews his findings of fractals in African material culture, and notes that we should resist making assumptions about the social dynamics associated with these structures, since they vary widely.

EGL-95c

Many of the fundamental concepts of cybernetics (self-organization, the binary code) have connections with the history of the black diaspora.

EGL-97a

Reflecting on his fieldwork realized among Bamana (or Bambara) diviners (Mali), the author compares their use of recursion, where the iterative function is addition modulo 2, with Cantor’s recursion (cantor set), and hypotheses that an African concept of self-generated fecundity is the shared origin of both the Bamana divination and transfinite set theory.

EGL-97b

“Benjamin Banneker (1731-1806) is well known for his accomplishments in early American applied science, as well as for his seminal role in African-American science history. Historical and linguistic evidence suggests that his grandfather was of Wolof origin, and that his father was from the area between what is now Ghana and Nigeria. This cultural heritage may have emerged in some of his mathematical thinking” (p.307).

EGL-98a
Analyses an ivory hat pin from the Mangbetu (northeastern Congo / Zaire) and the geometric algorithm involved in its production. The top of the pin is composed of four scaled, similar heads (forming isosceles right triangles in photographic projection).

EGL-98b
A comparison of fractals in African material culture and fractals in complexity theory.

EGL-98c

EGL-99
This beautifully illustrated book “introduces readers to fractal geometry and explores the ways it is expressed in African cultures. Drawing on interviews with African designers, artists, and scientists, Eglash investigates fractals in African architecture, traditional hairstyling, textiles, sculpture, painting, carving, metalwork, religion, games, practical craft, quantitative techniques, and symbolic systems. He also examines the political and social implications of the existence of African fractal geometry.”

EIS-77
Introduction to and translation of the Ahmose papyrus.
EKU-75 1975 Ekundayo, S. A.: Vigesimal number derivational morphology: Yoruba grammatical competence epitomized, Linguistics Department, University of Ife, Ife (Nigeria).


Describes the background and the history of the Library of Alexandria: from its creation in the early third century BC to the destruction of the Royal Library in 48 BC and of the Daughter Library in 391. Particular attention is given to the type of scholarship cultivated at Alexandria. Eratosthenes of Cyrene, author of ‘On the Measurement of the Earth’, was the chief librarian from 245 to 204/1 BC. Other mathematicians that are referred to, are Euclid (86), Heron (90), Claudius Ptolemy (141), Theon and Hypathia (159).


ELT-79a 1979a El Tom, Mohamed: The proliferation and popularization of mathematical results: the needs of the underdeveloped countries, in: Booss, Bernhelm & Niss, Mogens (Eds.), Mathematics and the real world, Birkhauser, Basel (Switzerland), 54-57.


ELT-79c 1979c El Tom, Mohamed (Ed.): Developing Mathematics in Third World Countries. Proceedings of the international conference
Includes three papers by African mathematicians:

* Mohamed El Tom (Sudan): The conference: Its background and work (3-22)
* A. A. Ashour (Egypt): Strategies and priorities in mathematical education and research in developing countries (25-31)

ELT-83

ENG-85

Presents an hypothesis on how the Ancient Egyptian formula for the determination of the area of a circle could have been obtained.

ENG-00

Notes a connection between an Egyptian and an Indian approximation of π and contains an analysis of the first Archimedean bounds for π and a reconstruction of the second Archimedean bounds mentioned by Heron of Alexandria.

ENU-79
ENU-86

Describes the Efik-Ibibio counting words system, which is a mixture of base five and base ten, and the local concepts of lines and shapes.

ENU-92

ERN-80

“This discusses different algorithms for representing rational numbers as sums of unit fractions (1/n), referring to and inspired by the Ancient Egyptian representation of fractions as such sums.”

ERN-81

“This describes a school based project for getting pupils to better appreciate mathematics through its history, and focuses on the Ancient Egyptian representation of fractions.”

ESH-74

The author asserts that neither the aims nor the practice of mathematics and science education in Kenya is attuned to the needs of society or of the individual learner. The traditional worldview differs radically from that of the western world. At primary level, traditional concepts of reality and causality are ignored and the problems of
linguistic transfer not appreciated. Practical reforms are suggested, with a particular emphasis on teaching mathematics and science in conjunction with traditional technologies.

ESH-75

Study aimed to find out whether there is a significant difference in achievement and retention in mathematics between boys and girls in Kenyan secondary schools, and to identify factors which are significant predictors of achievement. It was found that teaching methods were a significant differential predictor between the sexes, but that attitudes towards mathematics, and expectations of their sex roles, were not.

ESH-79

ESH-80

ESH-83a

ESH-83b
1983b Eshiwani, George: *A study of women’s access to higher education in Kenya, with a special reference to mathematics and science education*, Bureau of Educational Research, Kenyatta University College, Nairobi (Kenya), 75 p.
ESH-93

ETI-86

ETU-67

EUC-26

EUC-69
1969 Euclid of Alexandria: *Die Elemente* [The Elements], Wissenschaftliche Buchges., Darmstadt (Germany), 479 p. (in German).

EUC-90

Contains a general introduction by Maurice Caveing (13-148) and a translation and commentaries by Bernard Vitrac on the first four books of Euclid’s *Elements* on plane geometry based on the text by Heiberg (149-519).

112

Reprint of the translation of Euclid’s works by F. Peyard with a new introduction by Jean Itard.


Translation from the text of H. Menge (1896) by George L. McDowell & Merle A. Sokolik.


This is the French translation, by Bernard Vitrac, of Books V to IX of Euclid’s *Elements* based on Heiberg’s edition. The translation is preceded by an introduction and is accompanied by a number of commentaries.


An annotated translation by Bernard Vitrac of book X of Euclid’s *Elements*.


Reprint of the 1840 edition of Cooley’s edition of the *Elements*, which was intended primarily for educational purposes.

**EUC-01b**

2001b Euclid of Alexandria: *The Elements of Euclid for the Use of Schools and Colleges* (with notes, appendix, and exercises by Isaac Todhunter), Elibron, Boston MA (USA), 421 p. (paperback and electronic versions)

Reprint of the 1864 edition of Todhunter’s edition of the *Elements*; contains the first six books and portions of books XI and XII.

**EUC-01c**


It is the last volume (Books XI-XIII) of the project of new French translation by Bernard Vitrac of Euclid’s *Elements*, based on the Heiberg edition.
FAG-90

Analyzes the way in which wordplay is used as a device to aid the memorization of counting mnemonics in Yoruba (Nigeria).

FAI-85

“The author analyzes in sociological terms the widespread West-African tendency to associate the numbers 3 and 4 with man and woman respectively, practice usually attributed to certain aspects of male and female anatomy. An analysis of Bisa society (Burkina Faso) shows how the meaning and function of this symbolism are directly related to representations of the person on the one hand, and to social space as defined by residence rules on the other. The author suggests that the discourse implied by this symbolism serves to found social relations between the sexes and to legitimate male domination” (109).

FAK-80

FAT-91

Presents examples from measurement, games and riddles from Uganda and Congo / Zaire.
FAV-91

Analyses the comparative findings of a test on defining and visualizing a cube realized among Somalian and Italian students.

FED-91
1991 Federspiel, Michel: Sur la définition euclidienne de la droite [On the Euclidean definition of the straight line], in RAS-91a, 115-130.

FEDE-90

FEM-97a

FEM-97b

FEM-97a and FEM-97b are examples of a series of dissemination reports of the Female Education in Mathematics and Science in Africa (FEMSA) project, based on country profiles compiled by Rose Eboutou Mfou (Cameroon), Georgina Quaisie (Ghana), Verdiana Masanja (Tanzania), and Jane Mulemwa (Uganda).
Directed related to North Africa are the chapters by Djamil Aïssani and Dominique Valerian “Mathematics, commerce and society in Béjaïa (Bugia) at the time of the stay of Leonardo Fibonacci (12th – 13th century)” (in French), by Roshid Rashed “Fibonacci and the Latin continuation of Arabic mathematics” (in French), and by Ivo Schneider “The solutions of the two main problems concerning games of chance in the late European Middle Ages and the possibility of Islamic sources.”

FIN-93
1993 Finch, Charles S.: Africa and the Birth of Science and Technology, Khenti, Decatur GA (USA).

FIN-98

“The proto-technology of the modern world is traceable to iron ore mining 43,00 years ago in southern Africa and to the emergence of proto-mathematics from Africa’s Great Lakes region over 25,000 years ago. From these Paleolithic beginnings, science and technology underwent a steady development in Africa, and the remotest origins of formal mathematics, astronomy, engineering, architecture, navigation, and map-making can be found there.”

FINK-80
“The author has found among the Bono of Ghana terms which function as nouns and verbs and which reveal indigenous categories of linear distance, volume, weight, and time measures. The areas of applicability for mathematics and science teaching in local schools are pointed out.”

FIS-79

FLE-04

FLET-97

FOL-87

FOL-93

The following chapters, written by African historians and/or related to the history of Mathematics in Africa, are included:
* J. Hogendijk: The Arabic version of Euclid’s On Division
* R. Lorch: Abû Kâmil on the pentagon and decagon
* B. Rosenfeld: “Geometric trigonometry” in treatises of al-Khwârizmî, al-Mâhânî and Ibn al-Haytham
* J. Sesiano: The medieval Latin version of the Algebra of Abû Kâmil
* P. Kunitzsch, “The peacock’s tail”: on the names of some theorems of Euclid’s ‘Elements’ (205-214).

FOW-80

FOW-82

FOW-83

FOW-92

FOW-99

“It is often asserted that Euclid had no single word for “radius,” but rather used the description “the line drawn from the center.” We examine the linguistic practice of Euclid, Archimedes, and Appolonius and find that it is more subtle than that.”
“Mesopotamian mathematics is known from a great number of cuneiform texts, most of them Old Babylonian, some Late Babylonian or pre-Old-Babylonian, and has been intensively studied during the last couple of decades. In contrast to this Egyptian mathematics is known from only a small number of papyrus texts, and the few books and papers that have been written about Egyptian mathematical papyri have mostly reiterated the same old presentations and interpretations of the texts. In this book, it is shown that the methods developed by the author for the close study of mathematical cuneiform texts can also be successfully applied to all kinds of Egyptian mathematical texts, hieratic, demotic, or Greek-Egyptian. At the same time, comparisons of a large number of individual Egyptian mathematical exercises with Babylonian parallels yield many new insights into the nature of Egyptian mathematics and show that Egyptian and Babylonian mathematics display greater similarities than expected.”
G

GAF-87  

GAI-01  

“Accepting as a premise that numerical entities must be associated to the social reality in which they appear, this article exposes that ancient Egyptian fractions are considered to be expressions of the magnitude quantities which have been obtained after being equally shared-out. Taking into account this view, an exhausting analysis of the different cases collected in the table, which appears in the Recto of the Rhind’s papyrus has allowed as the reconstruction of the shared-out processes used by the scribe Ahmes. Such a process has been undoubtedly complex, due to the fact that, for each one of the situations collected in this table, the scribe must make those decisions, which will help the realization of a real share-out under the most suitable conditions. This reconstruction has enabled us to interpret Egyptian fractions as the addition of the partial results obtained when the share-out must be carried out following consecutive stages, as well as to devise two possible alternatives about the way in which the scribe would execute the numerical calculations associated to the share-out process.”

GAM-80  
1980 Gama Amaral, Manuel: A contagem entre os Wayao [Counting among the Yao], in: M. Gama Amaral, O povo Yao, Subsídios para o estudo de um povo do noroeste de Moçambique [The Yao people, a contribution to the study of a people from the Northwest of Mozambique], Instituto de Investigação Científica Tropical, Lisbon (Portugal), 437-441 (in Portuguese).
Describes finger counting and the spoken numeration system of the Yao.

GAN-50

Presents an overview of various graphic signs developed among the Bambara (Mali) to represent numbers.

GANN-64

GANN-65

GARD-91

GARD-94

GARE-94

“The purpose of this study was to find out the extent to which teachers of lower primary (Grades 2 & 3) used cultural games in teaching mathematics, and how they integrated such games in their instructional
practices. The study showed that teachers have little experience in using cultural games in mathematics teaching. However, it was shown that teachers use cultural games in teaching Setswana Language and Social Studies. The limitation of usage in mathematics lessons was due to lack of guidance on how to use them. Geometry was one of the topics in which cultural games such as ‘mhele’ and ‘morabaraba’ were used. The study is based on the survey of 145 teachers, ten (10) of which were interviewed.”

GARE-96
1996 Garegae-Garekwe, Kgomotso: Multiplication and division of numbers using cultural games: The case of ‘Diketo’, Mathematical Association of Botswana Newsletter, Gaborone (Botswana), No. 81, 10 -12.

“The article presents a lesson plan on how a teacher could teach addition and multiplication of whole numbers using one of the cultural games called ‘diketo’. This game is played by girls and boys (mostly played by girls) from age 5.”

GARE-02
2002 Garegae-Garekwe, Kgomotso: Teachers’ Beliefs about mathematics, its teaching and learning and the communication of these beliefs to students: A case study in Botswana, doctoral thesis, University of Manitoba, Winnipeg, Manitoba (Canada), 302 p.

“The study focused on teachers’ beliefs about mathematics, its teaching and learning and the communication of these beliefs to students. It is a qualitative case study of three Junior Secondary School mathematics teachers. Data collection techniques included classroom observations, interviews, concept maps, personal essays, and perusal of official documents. In addition to responding to open-ended questionnaires, students constructed concept maps about their teachers’ views about the teaching and learning of mathematics.”

GAR-54

Short comment on the words in Bambara (Mali) for 7, 9 (related to the duration of a pregnancy), 20 (related to the word for human being),
and 40 (related to the word for mat). As 7 is a secret number, the author does not know an expression for it other than the indirect ‘wuoron-fla’, that is, the ‘second six’.

GARR-81

GAY-67

This classical study of the Kpelle people in central Liberia reveals the extent to which mathematical ideas and techniques are built into their culture and language: where daily life demands it, a mathematical skill becomes highly developed. In the ‘western-style’ school these skills are mostly ignored. The final chapter of the book presents recommendations. The basic recommendation for the teacher is “to reverse the present pattern of education. Instead of using the traditional Kpelle authoritarian method of rote memory and imitation as means of introducing the Western content, the teacher should use the Western, scientific method for comprehending, clarifying and organizing content drawn directly from the child’s familiar, daily experiences” (p. 93).

GAY-71

Presents an analysis of mathematical terms in the Kpelle language of Liberia and indicates the range of concepts and skills with which Kpelle children arrive at primary school.
GEE-44

GER-80a

Describes the development of mathematics education in Mozambique in the first years after the independence of the country (1975-1980).

GER-80b

Introduction to the history of mathematics education in primary and secondary schools and in higher education in Mozambique during the colonial time and the first years after the independence of the country in 1975.

GER-81

Revised version of GER-80a.

GER-84

Describes the first Mathematics Olympiads in Mozambique and includes biographies of the winners.
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GER-85

New conjectures on the origin of the ancient Egyptian formula for the area of a circle are formulated on the basis of an examination of old African craft techniques, e.g. the transformation of an elongated rectangle in the form of a coiled rope into a circle.

GER-86a

Deals with a method for recognizing geometrical thinking ‘hidden’ in the forms of traditional (African) objects, like baskets, pots, fish traps, houses.

GER-86b

GER-88a

“Following a brief description of the drawing tradition of the Cokwe people (Angola), some possible uses of their pictograms in the mathematics classroom are suggested. The examples given in this paper range from the study of arithmetical relationships, progressions, symmetry, similarity, and Euler graphs to the determination of the greatest common divisor of two natural numbers.”

Translation: GER-89a.

GER-88b
1988 Gerdes, Paulus: On some possible uses of traditional Angolan sand drawings in the mathematics classroom, *Abacus, the*
Reproduction of GER-88a.

GER-88c

“This article confronts a widespread prejudice about mathematical knowledge, that mathematics is ‘culture-free’, by demonstrating alternative constructions of Euclidean geometrical ideas developed from the traditional culture of Mozambique.” Reproduced in: POW-97.

GER-89

Translation of GER-88a.

GER-90a

Presents a brief introduction to the Cokwe sand drawings from Angola and presents geometrical recreations of the “Find the missing figures” type, inspired by the variation of dimensions while maintaining the geometrical algorithm as practiced in the Cokwe tradition.

Translations: GER-91c, GER-97b.

GER-90b
1990b Gerdes, Paulus: *Vivendo a matemática: desenhos da África* [Living mathematics: Drawings of Africa], Editora Scipione, São Paulo (Brazil), 64 p. (in Portuguese).

Booklet for children age 8-14 on the mathematics of the Cokwe *sona* drawings from Angola.
The related papers GER-90c, GER-91a, and GER-91b present an introduction of the author’s research findings on mathematical ideas in the sand drawing (sona) tradition of the Cokwe people (Angola): symmetries and monolinearity, classes and geometrical algorithms, rules for the construction of monolinear sono; and discuss the educational and mathematical potential of this tradition. The examples given in the papers vary.

GER-91c

Studies the historical relationship between (the development of) geometrical knowledge and socially important activities (in Africa), such as mat and basket weaving, pot making and house building. In the second part of the book hypotheses on the early development of geometrical thinking are formulated, e.g. on the discovery of the ‘Pythagoras’ Theorem’ and of the ancient Egyptian formula for the volume of a truncated pyramid. The last part presents examples of didactical experimentation with the aforementioned incorporation. Peter Damerow wrote the preface, entitled ‘Ethnomathematics and Curriculumexport.’

Translations (partial): GER-91d, GER-92a, GER-03a.
GER-91d  
1991  Gerdes, Paulus: *Cultura e o despertar do pensamento geométrico* [Culture and the Awakening of Geometrical Thinking], Instituto Superior Pedagógico, Maputo (Mozambique), 146 p. (in Portuguese).

Translation into Portuguese of GER-91c, excluding the didactical experimentation.

GER-91e  

Translation into English and French of GER-90a. Presents examples of traditional sand drawings, called *(lu)*sona, from north-eastern Angola and geometrical recreations inspired by them. In the “Find the missing figures” activities the reader is given certain figures in the style of the ‘sona’ and invited to draw / create the missing figure(s) in the sequence.


GER-91f  

Discusses the appearance of fivefold symmetry in traditional craft work, especially from Mozambique.

GER-92a  
1992  Gerdes, Paulus: *Sobre o despertar do pensamento geométrico* [On the Awakening of Geometrical Thinking], Universidade Federal de Paraná, Curitiba (Brazil), 105 p. (in Portuguese).

Brazilian reproduction of GER-91d with a preface by Ubiratan D’Ambrosio.

Overview presented at the 3rd Pan-African Congress of Mathematicians (Nairobi, 1991) of research findings and of sources on or related to mathematics in the history of Africa south of the Sahara. Topics such as counting and numeration systems, mathematical games and puzzles, geometry, graphs, and continental and international connections are included.

Translation into Portuguese: GER-92d.
Updated version: GER-94f.


Includes two chapters related to the history of mathematics in Africa: ‘Did Egyptian artisans know how to construct a square equal in area to the sum of the areas of two given squares?’ (6-14) and ‘A new proof related to an Ancient Egyptian decoration technique’ (97-99). The other chapters show how diverse African designs may be used to discover and find proofs for the theorem of Pythagoras.

Translation: GER-94j.


Translation of GER-92b.

1993 Gerdes, Paulus (Ed.): *A Numeração em Moçambique* [Numeration in Mozambique], Instituto Superior Pedagógico, Maputo (Mozambique), 159 p. (in Portuguese).
Analyses the development of numeration systems in Mozambique and includes the following chapters:
* Paulus Gerdes & Marcos Cherinda: African systems of numeration (8-28);
* Paulus Gerdes: On the history of verbal numeration (29-34);
* Written sources on numeration and counting in Mozambique [languages: Makonde, Yao, Nyanja, Nyungwe, Makhuwa, Sena, Shona, Tshwa, Chope, Changana, Ronga, Swazi, Zulu] (35-106);
* Oral sources on numeration and counting in Mozambique (107-120), including: Abdulcarimo Ismael & Daniel Soares: Popular counting methods in Mozambique (114-120);
* Abílio Mapapá & Evaristo Uaila: Comparative tables and maps about spoken numeration in Mozambique (121-132);
* Jan Draisma: Spoken numeration as a resource in the learning of arithmetic (134-150);
* Some reflections to stimulate debate and research (151-159).

GER-93b
Abridged version of a paper on numeration systems in Africa.

GER-93c
Analyses ethnomathematics as a new research field in Africa and presents some reflections based on experiences in Mozambique.

GER-93d
Volume 1 is dedicated to the analysis and reconstruction of mathematical elements in the sand drawing tradition of the Cokwe and...
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neighboring peoples in Angola, Congo / Zaire, and Zambia. Symmetries, classes and algorithms for the execution of the drawings (called ‘sona’), and rules for the systematic construction of monolinear ‘sona’ are among the themes analyzed.

Translations: GER-94i, GER-95a, GER-97a, GER-06.

Example of a monolinear (lu)sona
(cf. GER-06, p. 71)

GER-93e

The second volume examines the educational and mathematical potential of the reconstructed ‘sona’ tradition.

Translations: GER-95a, GER-97a.

GER-93f

GER-94a
1994 Gerdes, Paulus: Geometria Sona: Reflexões sobre uma tradição de desenho em povos ao Sul do Equador [Sona Geometry: Reflections on a drawing tradition of peoples in Africa South of
The third volume presents a comparative analysis, studying traditions from other parts of Africa and the world and/or of other periods that are technically similar to the ‘sona’ tradition. It contains the following chapters: 9. On geometrical algorithms in Ancient Egypt, 10. On monolinear motifs in Ancient Mesopotamia, 11. On some geometrical algorithms in India, 12. Short excursion to other continents, and 13. Back to Africa.

Translations: GER-95a, GER-97a.

Example of a monolinear engraving from Ancient Egypt (cf. GER-95a, p. 479)

GER-94b

Analyses the technological and geometrical knowledge of basket weavers in Mozambique’s Inhambane province. Presents a catalogue of decorative strip patterns on woven handbags (sipatsi) and some
suggestions are made for an educational and mathematical exploration of ‘sipatsi’.

Translations: GER-94c, GER-94d.
Expanded edition: GER-03d.

GER-94c
Translation of GER-94b by Arthur B. Powell.
Review: ARO-95, VAQ-99.

GER-94d
Translation of GER-94b into French.

Example of a twill woven band on a *gipatsi* (cf. GER-94)

GER-94e
The following chapters deal with mathematics and culture:
* Abdulcarimo Ismael: On the Origin of the Concepts of “Even” and “Odd” in Makhuwa culture (9-15);
* Marcos Cherinda: Mathematical-educational exploration of traditional basket weaving techniques in a children’s “Circle of Interest” (16-23);
* Daniel Soares & Abdulcarimo Ismael: Popular counting methods in Mozambique (24-29);
* Jan Draisma: How to handle the theorem 8+5=13 in (teacher) education (30-48);
* Abílio Mapapá: Symmetries and metal grates in Maputo (49-55);
* Daniel Soares: Symmetric ornamentation on wooden spoons from Sofala Province (56-58);
* Marcos Cherinda: Strip patterns on wooden spoons from Inhambane Province (59-61).

GER-94f

Updated version of GER-92b.

GER-94g

Two examples of southern African geometries are briefly presented: the originally female geometry of the ornamentation of ‘sipatsi’ handbags in Mozambique’s Inhambane Province, and the male geometry of ‘sona’ sand drawings mostly of Eastern Angola and North-Western Zambia. The potential of these geometries for mathematics education is described.

GER-94h

Short paper on ethnomathematical research as an answer to one of the most important challenges to mathematics education in Africa.

GER-94i

**GER-94j**


Translation of GER-92c.

**GER-95a**


French language edition of GER-93d, GER-93e, and GER-94a.

**GER-95b**


The main objective of the book is to call attention to some mathematical aspects and ideas incorporated in the patterns invented by women in Southern Africa. It is meant as a contribution to the valuing, revival and development of traditions that may otherwise vanish. The themes treated in the book are: decorated handbags (Mozambique), coiled baskets (Swaziland), mat weaving, string figures, decorated pottery, grass brooms (Lesotho), tattooing and body painting, bead ornaments (Angola, Mozambique, South Africa), and mural decoration (Lesotho, South Africa).

Translation: GER-96b.
New Edition: GER-98d.
GER-95c


GER-95d
1995 Gerdes, Paulus: L’ethnomathématique en Afrique [Ethnomathematics in Africa], *Plot*, Orléans (France), No. 70, 21-25 (in French).

Reproduction of the introduction to GER-93c.

GER-96a

Reflects on ethnomathematics and the teaching and learning of mathematics.

GER-96b

GER-96c

Presents an introductory overview of mathematics in the history of Africa South of the Sahara.

GER-96d

Suggests the incorporation of aspects of traditional female activities in geometry teaching.

GER-96e

Develops the geometry of Lunda-designs, invented in the context of analyzing mathematically a class of sand drawings from northeastern Angola, a region called Lunda.

GER-97a
1997 Gerdes, Paulus: Ethnomathematik dargestellt am Beispiel der Sona Geometrie (Ethnomathematics through the Example of the Sona Geometry), Spektrum Verlag, Heidelberg (Germany), 433 p.

German language edition of the three volumes (GER-93d, GER-93e, and GER-94a) on the geometry of the ‘sona’ tradition in southern-central Africa. Preface by Harald Scheid and Erhard Scholz.
Reviews: HOY-98, KRAU-98, SCHM-98.

GER-97b

New edition of GER-91.

GER-98a

Presents a short history of mathematics teacher education in Mozambique since independence in 1975, highlighting the multicultural context and the role of the history of mathematics and of ethnomathematics in teacher education.

GER-98b

Presents some examples of geometrical ideas in traditional African building, as well as some further suggestions for architectural shapes inspired by African art and craft.

GER-98c
[available online at: www.uni-muenster.de/EthnologieHeute]

Presents an introduction to studies on ‘sona’ geometry (Southern Central Africa).

GER-98d


Example of a *litema* wall decoration (Lesotho)
(cf. GER-98d, p. 156; GER-99a, p. 92)

GER-98e

Presents a short overview of research on culture, mathematics, and mathematics education in Africa south of the Sahara, concentrating on southern Africa.

GER-99a

Presents geometrical ideas from Africa south of the Sahara, with suggestions how they can be explored both mathematically and in mathematics education (secondary school, teacher education, university). The book is organized in the following parts:
Preface (Geometrical and educational explorations inspired by African cultural activities); Part 1: On geometrical ideas in Africa south of the Sahara [overview, p.2-53]; Part 2: From African designs to
discovering the Pythagorean Theorem [p.54-87]; Part 3: Geometrical ideas in crafts and possibilities for their educational exploration [Explores ideas from house building, wall decoration, mat and basket weaving, p.88-155]; Part 4: The ‘sona’ sand drawing tradition and possibilities for its educational use [p.156-204]. Contains a foreword by Arthur B. Powell.

Reviews: MIC-99, PETER-99, ASC-00, ASH-00, INO-00, JOH-00, ZAS-00c, BARRO-01,

GER-99b

Text of a paper presented at the Fourth World Archaeological Congress, January 10-14, 1999, University of Cape Town, South Africa.

GER-00a

Analysis of mathematical aspects of the mats plaited by women of the Yombe people in the Lower Congo area at the end of the 19th century and the beginning of the 20th century.

GER-00b
2000 Gerdes, Paulus: *Le cercle et le carré: Créativité géométrique, artistique et symbolique de vannières et vanniers d’Afrique, d’Amérique, d’Asie et d’Océanie* [The circle and the square: Geometric, artistic and symbolic creativity of female and male basket weavers from Africa, America, Asia, and Oceania], L’Harmattan, Paris (France), 301 p. (in French).
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Presents, on the one hand, a comparative and structural analysis of a type of plaited circular tray or basket cover, produced in several regions of Africa, America, Asia and Oceania, and, on the other hand, some elements of a catalogue, complemented by comments on the cultural context, the techniques and some implied geometrical ideas. Chapters 2 to 5 deal with Africa: The Bedik in Senegal (Chapter 2, 23-76); The Twsa, the Tonga and the Chope in south-east Mozambique (Chapter 3, 77-100); The Makonde and Makhuwa in north-east Mozambique (Chapter 4, 101-130), Varia Africana (Chapter 5, 131-148). Preface by Maurice Bazin.

Makhuwa circular tray with woven multiple spiral structure  
(cf. GER-00b, p. 122)

GER-00c

Brief presentation of books on the history of science in Sub-Saharan Africa (Paper written in 1996).
GER-00d

Brief presentation of books on ethnomathematics, in particular related to Sub-Saharan Africa (Paper written in 1996).

GER-00e

An introduction to mathematical ideas in cultural traditions of Central and Southern Africa.

GER-01a


GER-01b

Opening address at the 2001 annual conference of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE).

GER-01c
2001 Gerdes, Paulus: Intrecci culturali [Cultural interweavings], in: P. Bellingeri, M. Dedò, S. di Sieno, C. Turrini (Eds.), Il ritmo
Describes some geometrical aspects of basket weaving in Mozambique.

GER-01d
Illustrates some geometrical-symmetrical aspects of African craft.

GER-01e
2001 Gerdes, Paulus: Exploring the Game of Julirde, Teaching Children Mathematics, NCTM, Reston VA (USA), Vol. 7, No. 6 (Focus issue: Mathematics and Culture), 321-327.
Illustrates how the ‘julirde’ game from the Fulbe in Cameroon may be explored in the teaching of geometry.

GER-02a

GER-02b
Short overview of the development of mathematical activity in Mozambique since the Independence of the country in 1975.

GER-02c
2002 Gerdes, Paulus: Sobre a Produção de Conhecimentos Matemáticos em Países da África Central e Austral [On the production of mathematical knowledge in Central and Southern Africa], in: Mariana Leal Ferreira (Ed.), Ideias Matemáticas de...
Povos Culturalmente Distintos, Global Editora, São Paulo (Brazil), 206-220 (in Portuguese).

Translation by Mariana Leal Ferreira of GER-99b.

GER-03a

Partial translation of GER-91c with a preface by Dirk J. Struik. Includes the following chapters: (1) Mathematicians on the origin of elementary geometrical concepts, (2) How did people learn to geometrize?, (3) Early geometrical concepts and relationships in societal activities, (4) Social activity and the formation of ancient geometry, (5) Conclusion.

Reviews: DAR-03, FLE-04, LUM-03a, ZAS-03b.

GER-03b

[available online at: http://umn.edu/home/marqu002 by going to the NST link].

Slightly modified excerpt constructed from the first, second, and third chapters of GER-03a.

GER-03c

The paper presents an update on strip patterns found on twill-plaited handbags and baskets made by Tonga artisans, mostly women. It includes a catalogue of 58 new strip patterns. All seven symmetry classes are represented. Attention is drawn to two particular types of strip patterns characterized by special plaiting structures.

GER-03d
2003 Gerdes, Paulus: Sipatsi: Cestaria e Geometria na Cultura Tonga de Inhambane [Sipatsi: Basketry and Geometry in the
Expanded edition of GER-94b. The book explains how artisans produce beautiful hand bags, called ‘sipatsi’ in Gitonga, a language spoken in the Mozambican province of Inhambane. The activity of weaving ‘sipatsi’ is originally a female activity. The book presents a catalogue of 362 decorative strip patterns plaited into the ‘sipatsi’, resulting from collecting ‘sipatsi’ for more than twenty-five years. It also includes suggestions for the mathematical-educational use of ‘sipatsi’, varying from the study of composition and symmetries to the study of progressions and pentagons. The book concludes with the presentation of some new phenomena in the production of ‘sipatsi’, underlining the geometric-artistic creativity of the basket weavers, and a comparison of ‘sipatsi’-patterns with some woven strip patterns from other cultures (Northeast of Mozambique, Mexico and Brazil). Alcido Nguenha, the Minister of Education of Mozambique, wrote the preface.

GER-03e

English language version: GER-04c.

GER-03f

Presents an analysis of mavuku containers produced by Makhua basket weavers in the Northeast of Mozambique. The containers consist of two twill woven circular trays. The paper analyses the symmetries and the geometric structure of the weaving designs. The know-how of the old master-weaver Mulaliha from Rapale receives particular attention.
GER-03g

Discusses a class of plane patterns encountered on twill-plaited baskets recently made by Tonga artisans, mostly women, where colored strands alternate with groups of natural-colored strands. Within the conditions considered by the basket weavers and taking into account the symmetries, they discovered all possible solutions.

GER-03h

GER-04a

Reproduction of GER-01a.

GER-04b

Analyses mathematical ideas involved in the designing and production of mats by Yombe women from the Lower Congo area at the end of the 19th century and the beginning of the 20th century.
Example of a Yombe woven plane pattern
(cf. GER-04b, p. 92)

GER-04c

English language version of GER-03e. Paper originally written for presentation at the international conference “Towards an encounter of rationalities” (Porto Novo, Benin, 2002).

GER-04d

GER-04e

An overview of the bibliography organized by region and country.
GER-04f

GER-04g

GER-05a

GER-05b
2005 Gerdes, Paulus: Ethnomathematics, geometry and educational experiences in Africa, in: Theophilus Okere, Chukwudi Njoku & René Devisch (Eds.), *All knowledge is first of all local knowledge*, Special issue of the *Africa Development Journal*, CODESRIA, Dakar (Senegal), Vol. XXX, No. 3, 48-65.

GER-05c

A *nirrosula* is composed of a series of plaited nonahedra. Each nonahedron is made with only one plant strip.

GER-06

New edition of GER-94i. Includes an appendix on “Mathematical research inspired by the *sona* tradition: the example of mirror curves, Lunda-designs and cycle matrices” (217-232).
Example of a symmetric (lu)sona composed of two monolinear halves (cf. GER-06, p. 122)

GER-07

Presents a catalogue of over 2000 doctoral theses by Africans in all fields of mathematics, including applied mathematics, mathematics education and history of mathematics. The catalogue is organized by African country of birth and/or citizenship. The introduction explains the purpose, criteria for inclusion, data collection, and scope of the catalogue. Equally information is given about distribution by country of the doctorate holders, localization of doctorate awarding institutions, distribution of doctorates by period and by gender, mathematical density of African countries, mobility of African mathematicians inside and outside the continent, mathematical families and the first male and female African mathematicians who earned a doctorate. The appendices contain lists of female doctorate holders, of holders of doctorates in mathematics education, and of doctorates awarded by African universities to non-Africans and of doctoral theses by non-Africans about mathematics in Africa. The last appendix gives an overview of activities of African mathematicians at the service of their wider communities, inclusive lists of African mathematicians serving as presidents of their universities and as ministers in national governments.


Discusses the transition from duodecimal to decimal numeration in some languages belonging to the eastern Kainju group (like Eggon) and some Western and Central Plateau languages (Nigeria).


Includes sections on mathematics in ancient Egypt (47-65) and in the Islamic countries (196-214).

1999 Getz, Chonat: Computer generation of geometric designs woven into the izimbenge using algorithmic processes developed in the field of fractal geometry, South African Journal of Science, Johannesburg (South Africa), Vol. 95, 434-439.

“Geometric designs woven into copper wire baskets (izimbenge) by the Zulu people of South Africa have been analyzed and regenerated on a computer using algorithmic processes developed mainly in the field of fractal geometry. The mathematical concept of self-similarity is used to facilitate the comprehension of several aspects of fractal geometry. The algorithmic processes used are the deterministic algorithm, the random iteration algorithm and the escape time algorithm.”
GIA-76a

Contains a brief analysis of the hypotheses of Gunn and Peet, Vogel, Neugebauer, Van der Waerden and Gillings on the origin of the ancient Egyptian formula for the volume of a truncated pyramid.

GIA-76b

Proposes a new deduction of the ancient Egyptian formula for the volume of a truncated pyramid, based on the successive determination of the volumes of particular pyramids and prisms.

GIA-78

GIB-96

Examples of string figures from Bhutan (Asia) and Kenya, Zambia and Swaziland are presented, and suggestions for their exploration in mathematics education are presented.

GIE-50
1927 Gillain, O.: *La science égyptienne; l’arithmétique au moyen empire* [Egyptian science: Arithmetic during the Middle Kingdom], Fondation Egyptologique Reine Elisabeth, Brussels (Belgium), 326 p.


GIL-66b

GIL-66c

GIL-67a

GIL-67b

GIL-68

GIL-69

GIL-72

GIL-74
GIL-79

GIL-81

GIN-78

Examines the development of mathematical thinking in two ethnic groups in Ivory Coast, Baoulé and Dioula, and “analyzes the role of culture in the development of thinking. Findings reveal that practical arithmetic procedures like addition and subtraction can develop without formal schooling and are heavily influenced by cultural conditions” (p. 26).

GIR-96
1996 Girndt, Uwe: Einige Untersuchungen zur altägyptischen Grundeinheit der Längen-messung [Some research on the ancient Egyptian basic unit for length measurement], *Göttinger Miszellen*, Göttingen (Germany), Vol. 151, 53-66.

GIV-70

GLA-27

GLAV-94
GLU-44

GNAE-98

Includes a discussion of the use of Pythagorean triples in Egyptian architecture, and hypotheses on the calculation with unit fractions and the approximation of the area of a circle.

GNA-81

GNA-85

GNA-86

GON-50
1950 González Echegaray, Carlos: *Los sistemas de numeración y los numerales en los pueblos de la Guinea Española [The numeration systems and numerals among the peoples of*

Describes counting methods using fingers, knots, pebbles, etc., and number words (mostly decimal, some with auxiliary base five) among the peoples of Equatorial Guinea.

GRAN-73

Analyses cardinal numeration in several language groups from Côte d’Ivoire (Mandé, Voltaïque, Krou, and Kwa, including Akan).

GRA-94

Two chapters deal directly with mathematics in Africa:
*  C. S. Roero: Egyptian mathematics (30-45);

GRA-96
1996  Grattan-Guinness, Ivor: Numbers, magnitudes, ratios, and proportions in Euclid’s ‘Elements’: how did he handle them?, Historia Mathematica, New York (USA), Vol. 23, No. 4, 355-375.

GRA-03

*  Milo Gardner: The Egyptian mathematical leather roll (119-134);
*  Gregg De Young: A new source of evidence for the lost Arabic translations of Euclid’s Elements (149-162).
In his book on children’s games of the Dogon in Mali, Griaule presents two examples of a secret numeration (one to ten) used (and maybe invented) by the children of the Pamyon and Guinna neighbourhoods and often not understood by children from other neighbourhoods.

Complements Klinghenheben’s paper (KLI-26) with further information on vigesimal numeration.

Teaching and mathematics in African languages: known experiences and problematics of the teaching of arithmetic, Agence de coopération culturelle et technique, Paris (France), 181 p.

GUE-91

GUE-96

GUE-98

GUE-99
1999 Guergour, Youcef: Les différents systèmes de numération au Maghreb, à l’époque ottomane: l’exemple des chiffres rûmî [The different systems of numeration in the Maghreb during the Ottoman epoch: Example of the rumi ciphers], Cahier du Séminaire Ibn al-Haytham, Alger (Algeria), No. 9, April, 11-22 (in French).

Presents a system of numeration, called “rumi ciphers” or “ciphers of Fez” or “register ciphers”, composed of 27 distinct symbols. This system was used in the Extreme Maghreb (today’s Morocco) in administration and in accounting.

GUE-00
2000 Guergour, Youcef: Les différents systèmes de numération au Maghreb: l’exemple des chiffres rumi [The different numeration systems in the Maghreb: The example of the rumi
The author presents and analyses a type of a non-positional numeration system with 27 symbols used by the administration in the Western Maghreb.

GUE-06

GUG-77

GUG-99

GUI-92

Having examined different domains where the ancient Egyptians might have been able to express a concept of “general fraction”, the author asserts that this concept was unknown to them. He shows also that the only domain where they operated with them was that of the “Egyptian numbers”, that is, essentially, the sums of whole numbers and days.
Bibliography: G

GUL-58

“When they are counting or mentioning numbers in their conversation some African peoples have certain conventional ways of indicating and emphasizing the numbers referred to by the manipulation of the fingers. In this note the conventional finger actions are described for two Nilo-Hamitic tribes – the Arusha of northern Tanganyika and the Turkana of north-western Kenya.”

GUT-96
1996 Gutenberg, J. & Imhausen, Annette: Das Zahlensystem der Ägypter -k-ein dezimalsystem? [The numeration system of the Egyptians: (not) a decimal system], *Discussions in Egyptology*, Oxford (UK), No. 36, 49-51 (in German).

GWA-67
HAA-67

HAD-89
1989 Hadfi, Hmida: *Mathematics in Ifriqya during the Middle Ages: Jerba*, Diplôme d’Études Approfondies, Faculté des Lettres et des Sciences Humaines, Université de Tunis 1, Tunis (Tunisia), 258 p. (in Arabic).


HADI-06

HAG-64

Describes the *kalah* (mancala) game as useful for arithmetic teaching.

HAN-99
1999 Hansen, Keven: Teaching mathematics (and history) with Egyptian fractions, in: D. Curtin, D. Otero & J. Wine (Eds.), *Combined Proceedings of the Sixth and Seventh Midwest
Presents a survey of computational and representational methods for Egyptian fractions up to the present. The author provides examples to include in a discrete mathematics course.

HARA-00

Volume 1 contains a chapter about the history of mathematics and astronomy in the Maghreb until the 15th century (429-443).

HAR-97

The first part of the thesis presents the life and work of the Maghrebian mathematician al-cUqbani and the mathematical activities in Tlemcen (Algeria) at his time. The second part is dedicated to a mathematical analysis of his work, that is a commentary of the famous *Manual of arithmetic operations* of Ibn al-Bannâ (d. 1321). The third and last part is a critical edition of the only surviving copy of the work of al-cUqbani.

HART-97

HART-00
HAZ-83
1983 Hazoume, Marc-Laurent: La numération en Gun, Gen et en Bariba [Numeration in Gun, Gen and Bariba], *Langues Africaines et échange des connaissances*, Conseil Interafricain de Philosophie, Cotonou (Benin) (in French).

HEA-64

HEBE-89
1989 Hébert, Elisabeth (Ed.): *Découvrir les mathématiques arabes* [Discover Arab mathematics], IREM de Rouen, Rouen (France), 149 p. (in French).

A document elaborated by a group of Moroccan students at the Institute for Research in Mathematics Education (IREM) in Rouen under the responsibility of E. Hébert. Describes the development of numeration, algebra, number theory, combinatorics, trigonometry, geometry, numerical analysis and calculus in the Islamic countries and its diffusion to Europe.

HEBE-95
1995 Hébert, Elisabeth; Aïssani, Djamil; Boufrioua, Abdelaziz; Bensmina, Youssef; Boréani, Jacqueline; Nordon, Nicole & Trotoux, Didier: *Quelques aspects des mathématiques d’Ibn al-Bannâ de Marrakech (1256 – 1321)* [Some aspects of the mathematics of Ibn al-Bannâ of Marrakesh (1256-1321), IREM de Rouen, Rouen (France), 130 p. (in French).

Based on the recent studies of Ahmed Djebbar and Mohamed Aballagh, the book presents to non-specialists some chapters of work of Ibn al-Bannâ. Presenting in parallel complete texts (given in their French translations) and multiple mathematical and cultural comments, it allows the reader to become acquainted with some aspects of mathematical knowledge of the 13th and 14th century.

HEB-58
HEND-75

HEN-86

A Piagetian-type study of children of the Nupe group of Central Nigeria. Interviewing 336 children, the author found skills developing better than concepts, and some differences by sex and urban-rural distinctions.

HER-39

HERT-84

HIT-92

Mathematician from Zimbabwe proposes dramatic replays of the mathematical journeys of the past as a tool and an art form worth exploring in mathematics education.

HOF-52
1952 Hoffmann, Carl: Zur Verbreitung der Zahlwortstämme in Bantu-sprachen [On the distribution of number word roots in Bantu languages], *Afrika und Übersee*, Berlin (Germany), Vol. 37, No. 2 (1952/3), 65-80 (in German).

Discusses the distribution of the roots for the number words 1 to 10. For the number words 2 to 5 and 10 the uniformity is greater than for the number words for 1, and 6 to 9 (p. 78).
This paper by the first president of the African Mathematical Union (1976-1986) is intended as an introduction to the contribution of Ancient Africa to world mathematics. After underlying the Black-African character of Pharaonic Egypt and analyzing the dialectics of intuitive and deductive reasoning, it is stated that mathematics in Pharaonic Africa was intuitive, demonstrative and rational; Africa is the mother of Geometry.

The book is an enriched and revised version of a Doctoral thesis defended at the University of Utrecht (Netherlands) in 1983. It contains a history of conics since the works of Apollonius, a biography of Ibn al-Haytham, a critical edition with translation and analysis of an important mathematical text: the tentative reconstitution, by Ibn al-Haytham, of the contents of Book VIII of the Conics of Apollonius, that the Arab mathematicians of the Middle Ages had not been able to find, and which is still today considered lost.

The book is an enriched and revised version of a Doctoral thesis defended at the University of Utrecht (Netherlands) in 1983. It contains a history of conics since the works of Apollonius, a biography of Ibn al-Haytham, a critical edition with translation and analysis of an important mathematical text: the tentative reconstitution, by Ibn al-Haytham, of the contents of Book VIII of the Conics of Apollonius, that the Arab mathematicians of the Middle Ages had not been able to find, and which is still today considered lost.
Bibliography: H

HOL-88

Suggests an explanation of how the summation method in ‘Demotic mathematical papyrus PMD 10520 (British Museum)’ could have been obtained.

HOUN-94

Analyses Fâ divination practices in the coastal zones of Benin from a mathematical point of view (theory of probability).

HOU-87

HOU-94
1994  Hountondji, Paulin (Ed.): *Les savoirs endogènes: pistes pour une recherche* [Endogenous knowledge: Research trails], CODESRIA, Dakar (Senegal), 345 p. (in French).

Includes HOUN-94 and TCH-94.
Translation: HOU-97.

HOU-97

Translation of HOU-94.

HOY-89
Gives an overview of ancient Egyptian mathematics and discusses its diffusion: “The full range of Egyptian mathematics was probably never diffused to the Palestinian area. From the time when the Israelite Kingdoms began approaching a redistributive economy, however, and when the royal scribes came in need of computational tools, epigraphic evidence shows that they took over the Egyptian hieratic numbers. ...They must have been imported together with at least part of that wider mathematical culture which they served. In all probability, the administration in the Divided Kingdom will thus have been effected by means of Egyptian routines and techniques.”

HOY-97

The author intends to “firstly, that Hero’s geometry depends to a greater extent than usually assumed on Near Eastern practical geometry or its descendant traditions in the classical world, and that the conventional image [of Hero] as the transformer of theoretical into applied mathematics is only a half-truth; secondly, that much of what is shared by Hero’s *Metrica* and the pseudo-Heronian collections assembled by Heiberg as *Geometrica* are shared borrowings from the same tradition...” (p. 67).

HOY-98

HUY-95

“Presents a first try-out about ethno-mathematics in Rwanda and Burundi, regions about which no such studies were done before, contrary to for instance West or Southern Africa or the Arab countries. Includes collaborations with Pierre Nzohabonayo (Univ. Burundi) and Désiré Karangwa (KIST, Rwanda).”
HUUY-96a

Presents mathematical ideas involved in the ‘igisoro’ board game (four-row mancala type game), displays decorative patterns from basketry, and analyses mathematical structures in drum music.

HUUY-96b

Describes the Ishango bone (Congo / Zaire) as a Mesolithic mathematical artifact, some interpretations of the notches, and uses. Shallit remarks in a letter to the editor (Vol. 19, No. 3, p. 7) that papers by A. S. Brooks present a date of 20,000 years ago (not 11,000 years ago as stated by Huylebrouck) for the bone. Yet, no polemics was engaged to set its true age at 22,000 years ago (20,000 B.C.) in an additional letter to the editor.

HUUY-97

“Summarizes the popular ‘astronomical’ and ‘arithmetical’ explanations about the origin of the base 12 and the related use of the number 60, to reject them in favor of the ethnomathematical counting hypothesis the phalanxes of one hand with the thumb.”

HUUY-98

“A vulgarization about the Ishango rod, the oldest mathematical object, in a glossy science magazine for a wide audience. Includes large color pictures.”
“In the 1968 movie *2001, A Space Odyssey* the opening scene shows a human ancestor throwing his first discovery, the use of a bone as a tool, into space. As to realize Kubrick’s metaphor, the Ishango rod was brought in zero gravity during a parabolic flight of the European Space Agency. By carrying this oldest mathematical object with him, moviemaker Georges Kamanayo (Rwanda) became the first weightless ‘African-European’.”

“A rather assertive paper in which the author expresses his disappointment for the lack of interest in Flanders (Belgium) for African mathematics.”

“Presents details on the Ishango rod, original pictures of the excavation site, a paper model of the object, explanations about the difficulties with the dating of the object, and, in particular, the new interpretation of the notches by V. Pletser.”

This book is the by-product of more than hundred lectures given around Belgium for pupils of high schools and candidates for working
in developing countries. It contains the following parts and chapters: Chap. 1 “Ethno-mathematics: why?” (p. 9-17); Chap. 2 “Sources for African ethno-mathematics” (19-26); Part 1 “Introductory mathematical voyage,” Chap. 3 “Narrative and musical introduction” (29-44); Chap. 4 “Creative counting in Africa” (45-62); Chap. 5 “Drawing” (63-83); Chap. 6 “Reasoning without writing” (85-111); Chap. 7 “Multiplication following the Yoruba and Ethiopian way” (113-128); Part 2 “The Ishango bone”, Chap. 8 “The Ishango site” (131-142); Chap. 9 “Mathematical notches” (143-153); Chap. 10 “Missing link” (155-169); Chap. 11 “Not out of Africa” (171-180); Part 3 “Multicultural mathematics, from Africa to space,” Chap. 12 “Black mathematics” (183-212); Chap. 13 “An imaginative idea” (213-226); References (227-236).

HUY-05

New edition of HUY-03.

HUY-06

“The paper provides a summary of (black) African ethnomathematics, with a special focus on results of possible interest to eventual mathematical properties of the Ishango rod(s). The African diversity in number names, gestures and systems (including base 2 of the Bushmen, probably related to the early Ishango people) shows frequent decompositions of numbers in small groups (similar to the carvings on the rod), while the existence of words for large numbers illustrates counting was not merely done for practical reasons. A particular case is the base 12, with it straightforward finger counting method on the hands, and used in Nigeria, Egypt and the Ishango region. Geometric representations are found in traditional sand drawings or decorations, where lines and figures obey abstract rules. Number lines drawn in the sand (using small and long lines as on the rod) make anyone immediately remind the Ishango carvings. Knotted strings and carved counting sticks (even looking like exact wooden copies of the Ishango rod) illustrate an African counting practice, as confirmed in written sources of, for instance, a gifted American slave.
Finally, mancala mind games, Yoruba and Egyptian multiplication (using doublings as on the Ishango rod) or kinship studies mathematical language, ever since.”

HUY-07a
2007 Huylebrouck, Dirk: Wat had de vroege mens op zijn kerfstok? [What was the early human counting on a rod?], EOS Magazine, Antwerp (Belgium), No. 3, 36-41 (in Dutch).

HUY-07b
2007 Huylebrouck, Dirk: L’Afrique est le berceau des mathématiques [Africa is the cradle of mathematics], EOS, le magazine des sciences, Antwerp (Belgium), No. 3, 24-29 (in French).

Translation of HUY-07a. Analyses the various interpretations of the first Ishango rod and presents a first analysis of a second counting rod found at Ishango in 1959 by Marcel Spinglaer, a collaborator of Jean De Heinzelin who had found and studied the first rod.
IBN-83

Contains the first three books of the famous work of Ibn al-Haytham (d. 1039) on geometrical Optics: “The manner vision is realized in general” (Book I), “Census of elements that vision observes, their causes and the way to perceive them” (Book II), “The errors of direct vision and their causes” (Book III). This edition is preceded by an Introduction that presents the life of Ibn al-Haytham, his different contributions to Optics and the influence of his work on later studies in Optics in the Arabic tradition, and in Europe.

IBN-89

Comprises the English translation of the first three books of *The Optics* of Ibn al-Haytham. This translation is complemented by an introduction with commentaries, and an Arabic-Latin glossary.

IBN-90

IBN-02

IGB-67
Mathematics in African History and Cultures

IHS-00

Includes the papers ABA-00, DJE-00b and GUE-00.

IMH-96
1996 Imhausen, Annette: *Probleme ägyptischer Mathematik am Beispiel des mathematischen Papyrus Moskau* [Problems of Egyptian mathematics through the example of the mathematical Moscow Papyrus], Masters thesis (Staatsexamensarbeit), Mainz University, Mainz (Germany) (in German).

IMH-99a

IMH-99b

IMH-01
2001 Imhausen, Annette: Die aHa-Aufgaben der ägyptischen mathematischen Texte und ihre Lösungen” [The aHa-problems in Egyptian mathematical texts and their solutions], in: C.-B. Arnst et al. (Eds.), *Begegnungen. Antike Kulturen im Niltal*, Verlag Helmar Wodtke und Katharina Stegbauer, Leipzig (Germany), 213-220 (in German).

IMH-02
2002 Imhausen, Annette: The Algorithmic Structure of the Egyptian Mathematical Problem Texts”, in: John Steele and Annette

IMH-03a  

“This technical analysis of ancient Egyptian mathematical algorithms is based on a catalogue of Middle Egyptian mathematical texts. The study considers the presentation of Egyptian mathematics as collections of algorithms, and the application of mathematical texts in everyday life and business. The catalogue presents the texts in hieroglyphs with a transcription and commentary.”

IMH-03b  

“The extant sources for ancient Egyptian mathematics are extremely limited. It is therefore necessary to read the few sources carefully and use additional information from further Egyptian sources in order to achieve the most detailed picture possible. Traditional approaches to Egyptian mathematics have provided only a superficial account of mathematical practices and almost no information about the role of mathematics within Egyptian culture. To enlarge our knowledge it is crucial to use a different methodological approach in the analysis of ancient mathematical techniques. In addition, it is indispensable to contextualize the mathematical problems with sources that are not specifically mathematical per se. In this article I discuss several possibilities for these additional sources, such as administrative texts, reliefs found in tombs, and other archaeological evidence. I exemplify the use of these sources with two problems from the Moscow mathematical papyrus.”
“This article discusses the handling of rations in Middle Kingdom Egypt (2119-1794/93 BC) as it is displayed in three types of texts: mathematical problem texts, administrative ration texts (‘real’ ration texts), and literary texts. The example of handling rations is used to examine the relation between mathematical problem texts—which served according to the ‘opinio communis’ to educate scribes— and administrative texts, the actual documents from the professional life of scribes. Using one specific example, the use of a mathematical technique from the problem texts within a ration text is demonstrated. The presentation is complemented by passages from literary texts referring to rations.”

“Among the Lahun papyri a small number of fragments can be identified as mathematical texts, i.e. texts that have been written to record a mathematical procedure or used to carry out a mathematical procedure. Very few sources of ancient Egyptian mathematical texts are still extant. Of these, the mathematical fragments of the Lahun papyri hold a significant place. They contain both table texts and problem texts. While they are in many respects like the two major sources, the Rhind (mathematical) papyrus and the Moscow
(mathematical) papyrus, they also show a number of significant details that are not seen in any other text.”

INO-00

IRE-77

IRE-95
1995 IREM de Montpellier (Ed.): *Proceedings of the First European Summer University “History and Epistemology in Mathematics Education” / Actes de la Première Université d’Été Européenne “Histoire et Épistémologie dans l’Éducation Mathématique”*, Université de Montpellier II, Montpellier (France), 598 p.

The following are contributions by Africans and / or deal with mathematics in the history of Africa:
* Bebbouchi, Rachid: À propos de la continuité [About continuity] (85-89);
* Assem, Ali: Relations entre l’enseignement et les facteurs culturels — Qu’en est-il des mathématiques élémentaires en Algérie? [The relationship between education and culture — what is the case of elementary mathematics education in Algeria?] (305-307);
* Aissani, Djamil: Bougie médiévale — centre de transmission méditerranéen [Medieval Béjaïa — centre of Mediterranean transmission] (499-506);
IRU-84
1984 Irumu, Agozia-Kario: Le système numéral ‘logo’ face au système numéral ‘bangala’: un cas d’emprunt linguistique [The Logo numeral system compared with the Bangala numeral system: a case of linguistic borrowing], Bulletin de l’AELIA (Association d’études linguistiques interculturelles africaines), Bureau européen de l’AUPELF, Paris (France), No. 7 (in French).

ISM-06

Presents examples of probabilistic ideas in games played in Mozambique and suggest ways to use them in teaching mathematics.

ISO-92

Editorial on the place of mathematics in the history of Africa and in contemporary Africa which expresses the “need for mathematicians in Africa to write textbooks to reflect our cultural background, and ensure that mathematics is firmly grounded within our environment” (p. 6).

ITA-62

ITO-80
JAC-69

JAC-84

JAM-99

Presents examples of cultural elements from Somalia that may be explored in mathematics education.

JAN-05

Analyses aspects of Maninka sand divination (geomancy), in particular, the arithmetic and logic of several formal operations.

JAO-86
1986 Jaouiche, Khalil: *La théorie des parallèles en pays d'Islam* [The theory of parallels in the Islamic countries], Vrin, Paris (France), 266 p. (in French).

This is the French part of a publication in two volumes that includes the analysis, critical edition and French translation of the principal investigations of Arabic mathematicians on the 5th Postulate in Book I of Euclid’s *Elements*, i.e. on the Parallel Postulate. In the first part the author analyses and translates 12 texts, in particular those of an-Nayrîzî (10th C.), al- Jawhari (10th C.), Thâbit Ibn Qurra (d.901), Ibn
al-Haytham (d. 1040), al-Khayyâm (d. 1131) and Nasîr ad-Dîn at-Tûsî (d. 1274).

JAO-88

Critical edition of texts published in 1986 in a French translation (JAO-86), preceded by an introduction and a presentation of the used manuscripts.

JOH-65

JOHN-00
2000 Johnson, Julia: Review of Gerdes’ Geometry from Africa (GER-99a), Crux Mathematicorum, Ottawa (Canada), September, 278-279.

JOS-91

The author states in chapter 1 that the “standard treatment of the history of non-European mathematics exhibits a deep-rooted historiographical bias in the selection and interpretation of facts, and that mathematical activity outside Europe has as a consequence been ignored, devalued or distorted” (p.3). In the subsequent chapters he contributes to an alternative perspective. With respect to Africa, it is noted that “Much research needs to be done...” (p.22). Information is given on the Ishango bone (23-27), on Egyptian mathematics (57-90, 125-129), on the Zulu counting system (43-44) and on Yoruba arithmetic (44-46).
JUL-89

Contains the keynote address by Paulus Gerdes and discussion contributions from Cyril Julie, Yousuf Gabru, Daya Reddy, Brent Walters and Jan Persens.

JUL-91a
1991 Julie, Cyril (Ed): *People’s Mathematics: Early Ideas and Debates*, University of the Western Cape, Cape Town (South Africa).

JUL-91b

JUL-96

JUL-98

“Within various school mathematics dispensations in South Africa the intention for cross-curriculum work is expressed in the official documents describing the intended school mathematics curriculum. The paper traces this expressed intention from 1962 to 1998. The view is adopted that textbook authors are the major interpreters of the intended curriculum and therefore the manifestations of the cross-curricular ideal in school textbooks for the various periods are described and commented on.”
KAN-82
1982 Kane, Elimane Abdoulaye: Topologie archaïque [Archaic topology], Revue Senegalaise de Philosophie, Dakar (Senegal), Vol. 1, 75-90 (in French).

KAN-87

Studies spoken numeration systems in about twenty languages in Senegal, of which some are spoken only by some tens of people (like the Bapé, Bassari, Bédik and Koânagi languages). Analyses the understanding of the reforms that took place in these numeration systems, in particular of the spectacular evolution of some of them, like those of the Mandé group. It shows that the spoken numeration systems are susceptible to reform and evolution. Volume 1 deals essentially with cardinal numeration. Volume 2 is dedicated to the symbolic numeration systems.


KAN-91
1991 Kane, Abdoulaye Elimane: Systèmes de comptage africains et préarithmétique: de l’opération à la categorization [African counting systems and pre-arithmetic: from operation to categorization], Épistème, revue sénégalaise d’histoire, sociologie, philosophie des sciences et techniques, Dakar (Senegal), No. 2, 83-91 (in French).

KANG-05
KANI-86

Presents aspects of mathematics in Islam, especially as studied by the Islamic scholars of pre-colonial northern Nigeria, and notably by Muhammed ibn Muhammed al Katsinawi (c.1740) who worked on ‘magic squares’ and numerological patterns.

KANI-92a

KANI-92b

Considers *‘Ilm al-Hisab* (arithmetic) as part of the Islamic sciences introduced some time after the 11th century in Nigeria, first in Kanem-Borno and later, probably 15th century in Hausaland. Arithmetic being taught in both ‘secular’ and Islâmiyya schools, was used in the courts (calculation of inheritance), collecting and distributing zakât (poordues), business and land surveying. Scholars of Hausaland and Borno consulted Coptic Solar Calendars in determining their economic activities, especially agricultural ones. The author concludes his paper with the following remarks: “Despite the availability of a great deal of literature on medicine, astrology, arithmetic and other related sciences, written in Arabic, Fulfülde, Hausa and other languages, little effort has been made to systematically study these sciences within the historical perspective. The intellectual output of the *‘Ulamâ* (scholars) in this area has been wrongly classified by our contemporary historians and social scientists under the rubric of ‘mysticism’. A serious investigation into the literary output of the scholars of the Western and Central Sûdân, however, may reveal the fact that these scholars had explored agricultural, medicinal, astronomical and mathematical sciences long before the advent of colonial rule” (p.38).
“This article studies the teaching of mathematics in bilingual education in the Bambara-speaking town of Ségou. The bilingual principles of convergent pedagogy are examined in the light of teaching material, teacher training and classroom practice. It shows that neither the textbooks nor the training enable the teachers to follow the pedagogical principles that have been laid down, and that the transition from Bambara to French, which takes place in the 4th grade as far as mathematics is concerned, still represents a great problem in the 5th grade. However, the fieldwork, which took place in 1997, revealed an interesting method that seemed to be a local invention. Building on the Bambara play of riddles, different groups challenge each other both in creating and solving mathematical problems, and the children participate eagerly in this game. This type of teaching fits in well with active pedagogy and could be introduced into convergent pedagogy at a general level.”

KAP-01

KAR-99

KASA-92
KAS-77

KAT-96

Presents an introductory overview of mathematics in Ancient Egypt.

KAT-07

KAZ-83
1983 Kazadi, Corneille wa Mashinda: *Sur quelques difficultés dans l’enseignement des entiers négatifs aux élèves du 1er cycle de l’enseignement secondaire au Zaïre* [On some difficulties of the teaching of negative numbers to pupils of the first level of the secondary school in Zaire (DR Congo)], doctoral thesis, Université de Paris 7 (France) (in French).

KAZ-88

KAZI-02


“As South Africa moves forward with new curricular initiatives which are aimed at the elimination of many disparities, questions about what needs to be done in order to address the inequities to mathematics arising from the education system under the apartheid regime are also being asked. Such disparities certainly extend to mathematics. I believe questions about what is / has been taught in various subjects should be an important consideration. Reconstruction of the educational system must be in accordance with national policy that education should be non-sexist, non-racist and committed to equal access.”
KHU-00

KHU-04

KIB-80

KIE-55

Prepresents a brief survey of Egyptian geometry based on the papyri that have been found, followed by the interpretations which scholars placed on the geometric marks found on the Egyptian works of art. Finally, Lange’s law of frontality is discussed, with its revision by Schäfer.

KIES-87

KIES-90

KIES-91
1991 Kiese, M’boka: Mathématiques et Langue kikongo (Suite) [Mathematics and the (ki)kongo language (continuation)], *Revue Paari*, Paris (France), No. 4, 89-91 (in French).
KIES-01

KIL-05

KIN-97
1997 King, Vanessa: The impact of Dogon religious beliefs on their concept of numbers, Pythagoras, Cape Town (South Africa), No. 44, 24-26.

Article based on information contained in M. Griaule’s Conversations with Ogotemmeli (Oxford University Press, 1965).

KLE-88

Contains little information on measurement in Africa: Egyptian length measures (‘cubit’ and ‘foot’, 59-61); Egyptian weighth ‘ratl’ (86); ‘Cape foot’ from South Africa (63).

KLEP-72
1972 Klepzig, Fritz: Kinderspiele der Bantu [Games of Bantu children], Verlag Anton Hain, Meisenheim am Glan (Germany), 563 p. (in German).

Includes games of chance, string figures, board games and riddles.

KLI-26

Analyses different numeration systems in Berber languages in northwest Africa: mostly decimal, sometimes quinar-trigesimal
(Nefusa language), sometimes vigesimal (Sus region [Morocco]) and the interaction with Arabic.

**KLU-37**
1937 Kluge, Theodor: *Die Zahlbegriffe der Sudansprachen, ein Beitrag zur Geistesgeschichte der Menschen* [The number concepts in the Sudanese languages, a contribution to the spiritual history of man], edition of the author, Berlin-Steglitz (Germany), 260 p., 17 maps (in German).

Presents the number words in 976 Sudanese languages and dialects, organized in 16 regional groups from the Senegal-Guinea to the Nile-Chad. A comparative analysis of the languages in each group is included. The sources (mostly grammars and dictionaries) used by the author are indicated.

**KLU-38**
1938 Kluge, Theodor: *Die Zahlbegriffe der Australier, Papua und Bantuneger nebst einer Einleitung über die Zahl; ein Beitrag zur Geistesgeschichte des Menschen* [The number concepts of the Australian, the Papua and the Bantu Negroes together with an introduction to number; a contribution to the spiritual history of man], edition of the author, Berlin-Steglitz (Germany), 304 p. (in German)

The section on Bantu languages presents first the number words in 274 Bantu languages (and dialects), organized by geographical region (197-276), followed by a comparative analysis of the number word root and structure (277-300). The sources used by the author are not indicated.

**KNO-76**

**KNO-85**
KNO-91a

KNO-91b

KNO-92

KNO-93

“Two ancient works, cited in ancient sources as the “Preliminaries to the Arithmetic Elements” and the “Preliminaries to the Geometric Elements” - of which the former is no longer extant, while the latter is an alternative designation of the Definitions, now commonly attributed to Hero of Alexandria - are here argued to be companion works by the same author, namely Diophantus of Alexandria. This attribution has implications for the dating of Diophantus.”

KON-91
1991 Kondangba, Yembeline: Structure des numéraux en bantu (lingcmbè) et en non-bantu (ngbaka minagende, ngbandi, ngbundu, mcnc, mbanza) [The structure of numerals in Bantu (lingcmbè) and non-Bantu languages (ngbaka minagende, ngbandi, ngbundu, mcnc, mbanza)], *Annales aequatoria*, Mbandaka (DR Congo), Vol. 12, 307-319 (in French).

Describes and compares the numeration systems of five languages spoken in the Equator administrative region of the DR Congo.
KOU-99
Contains an analysis of a certain number of Arab texts produced between the 10th and the 14th century, which deal with the solution of linear equations and of systems of linear equations by means of the methods of false position.

KRA-83
Chapter 1 deals with Africa (1-7): Egyptian match, Egyptian numeration system, Senet (Egypt) and Wari (West Africa) games.

KRAU-98

KRE-89

KUB-86
“In pre-colonial times, a varied range of graphic systems existed in Sub-Saharan Africa. The author presents the results of his own investigations made in Tanzania, Malawi, Gabon, Cameroon, Angola and Zambia between 1962 and 1984.” The author analyses also tusona-luchazi-ideographs. “The forefathers of the Eastern Angolan peoples discovered higher mathematics and a non-Euclidian geometry on an empirical basis applying their insights to the invention of these [tusona] unique configurations” (p.108).
In this paper the author deals with those pictographs of Eastern Angolan culture that are characterized by a highly geometrical construction and examines their space/time relationships. He shows that these drawings “flourish upon abstract principles of a mathematical nature similar to those in some older traditions of African music.”

Describes and analyses the tusona tradition as practiced among the (Va)Luchazi in northwestern Zambia. In the introduction to chapter 14, entitled “The mathematics of the ‘tusona’ tradition” (195-227), the author states that “The majority of ‘tusona’ is based on the combination and the geometrical relationships of regular numerical components. Some of these relationships are so highly complex that we can presuppose the existence of empirical mathematical knowledge in the history of the eastern Angolan / northwestern Zambian culture area.” He discusses the “rules of behaviour” for the drawing of a particular class of ‘tusona’.

KUB-90
Dilemma tales are discussed on the basis of recordings and cinematographic documentation of narrative performances from eastern Angola and northwestern Zambia. In the oral literature of the Valuchazi, use is sometimes made of explanatory visual symbols, or ideographs, drawn in the sand. This is exemplified by Chindamba Ngunga’s dilemma tale, transcribed and analyzed in this paper: “This particular dilemma tale is about three women and three men who want to cross a river in order to attend a dance on the other side. With the river between them there is a boat with the capacity for taking only two people at one time. However, each of the men wishes to marry all the three women himself alone. Regarding the crossing, they would like to cross in pairs, each man with his female partner, but failing that any of the other men could claim all the women for him self. How are they crossing?” (p. 62).

KUK-93
1993 Kuku, Aderemi O.: *Mathematical research and education in Africa: problems and prospects* (Invited address at the joint AMS, CMS, MAA meeting at the University of British Columbia [Vancouver, Canada] on 16.08.1993), AMU.

Includes a short history of the African Mathematical Union.
LAA-90

LAA-06

LAB-81

LAG-68

Gives an overview of the ethnographic literature on mnemonic aids in counting in Sub-Saharan Africa. Map on p.126 displays the distribution of tally-strings over the continent. The most important tallies of higher age are the “memorial cairns (i.e. the custom that every one passing a place where someone for instance has suffered a violent death throws down a stone or a stick).”
LAG-73

LAM-68

Describes briefly counting and measuring among the Sundi. Accounts are kept by means of stones, palm nuts, knots, tally sticks, etc. In games the score may be kept by putting aside certain objects, by tying knots in a string, or by chanting a jingle (examples are given).

LAMB-81
1981 Lamrabet, Driss: *La mathématique maghrébine au moyen-âge* [Maghrebian mathematics during the Middle Ages], thesis (Mémoire de Post-Graduation), Free University of Brussels (Belgium), 160 p.

LAMB-94

This book is in three parts. In the first part the author presents a short introduction to mathematical activity in Egypt, Babylonia, India and ancient Greece (p. 2-9); followed by a chapter on “The birth of Arab mathematics: the Islamic East” (p.10-19) and by a third chapter on “The mathematics of the Islamic West: Andalusia” (p.20-41). The second part contains bio-bibliographical files of Maghrebian mathematicians and presents the contents of some mathematical works produced in the Maghreb. The third part contains “extracts of Maghrebian mathematicians” relative to Arithmetics, Algebra and Geometry.

LAMB-03
Applications, École Normale Supérieure, Rabat (Morocco), 154-168.

Presents examples of mathematicians in North Africa or the Maghreb until the beginning of the 14th century. Firstly, examples are given from the pre-Islamic period like Theodorus (465-398 B.C.), Eratosthenes (276-194 B.C.) and Nicotelese (c. 250 B.C.) of Cyrene, Theodoses of Tripoli (2nd century B.C.) and Apuleius of Madaura (124-170 A.D.). Secondly, examples are presented from the Islamic period. Particular attention is given to al-Hassar (c. 1150 A.D.), Ibn Mun'im (d. 1228) and his work in combinatorics, and Ibn al-Banna (1256-1321). The paper concludes with examples from mathematical notation and algorithms developed in the Maghreb.

LAN-89

LANG-95
1995 Lange, Robert; Maurice Bazin and Modesto Tamez: Playing games: Madagascar solitaire, in: Bazin, Maurice & Modesto Tamez (Eds.): *Math across cultures*, Exploratorium Teacher Activity Series, San Francisco CA (USA), 15-22 (reproduced in BAZ-02).

Suggestions for teachers on how to use a solitaire board game from Madagascar in the mathematics classroom.

LAR-04

LAS-75
LAS-80

LAS-84
1984 Lassa, Peter N.: *The sorry state of mathematics education in Nigeria* [Inaugural address delivered at the University of Jos on 20th January, 1984], University of Jos (Nigeria), 21 p.

LAS-86a

LAS-86b

Translation of LAS-86a into French.

LEA-87a

LEA-87b

Reports on an investigation into traditional mathematics in Botswana carried out by University students. Old people were interviewed to ascertain how mathematical activities were carried out in the past, and how some older people do mathematics today. Contains information on counting, arithmetical operations, geometrical forms, and measurement of length, volume and time.

LEA-89a
“A good example of what mathematical ideas were used before recorded history, can be seen today in the daily activities of Bushman society. They carry out mathematical activities suitable for their traditional way of life, and their highly developed spatial abilities are very necessary for survival in their harsh environment” [p.1]. The paper describes counting (one, two, two-one, two-two, two-two-one etc.), measurement, time reckoning, classification, tracking and mathematical ideas in technology and craft. “Bushmen have the oldest pattern of life found in the world today... A hunting and gathering community does not have need of counting precise measurement though requires basic skills for survival, and very special skills to interpret the environment. They need very good visual discrimination and visual memory” [p.7].

“Hunters and herdsmen in the Kalahari, who have never been to school and who have lived in very remote areas all their lives, were interviewed on two occasions to ascertain how far their spatial concepts have developed. When asked how they recognized animal footprints, and how they found their way in the desert, they were seen to have a very good visual memory, and to be aware of the minutest detail in recognizing shapes. When given a visual thinking test, they performed with a high degree of skill on items related to their environment.”
“In the ongoing discussion of the nbj measure the author deals with his interpretation of the nbj in the Senenmut ostraca as a measurement of volume, a cubic measure, whereas Roik defends a linear measure.”
With respect to the canon of proportions he also replies to the points raised by Roik with regard to the claimed use of the units of the rod-65.”

LEVE-66

LEV-29

Compares aspects of (finger) counting of the Bergdama (Berg Damara) of South Africa and Namibia with the (verbal) counting of their neighbors, the Nama.

LIE-90

Studies first the evolution of hunter-gatherer subsistence in general, and thereafter the hunter-gatherers of the Kalahari in southern Africa in particular. Principles of tracking, classification of signs, and spoor interpretation are analyzed. The author asserts “it is possible that the development of tracking played a significant role in the evolution of the scientific faculty” (p.48). “The critical attitude of contemporary Kalahari Desert trackers, and the role of critical discussion in tracking suggest ... that the rationalist tradition of science may well have been practiced by hunter-gatherers long before the Greek philosophic schools were founded” (p.45).

LIN-08

“... Odd numbers are generally considered disastrous or at least unlucky...” A contrary state of affairs is encountered “at a medicine man’s divination, as the pebbles that fall out of his calabash are a good omen if they are odd and vice versa...” (p. 306).
LOB-03

LOO-90

LOR-87

LOR-95

LOU-82

Analyses mathematical knowledge embedded in oral tradition and on games and gold weights.

LUB-00

LUM-79
Mathematics in African History and Cultures

Booklet for children with information on ancient Egyptian number symbols and arithmetical procedures (New edition: LUM-92a).

LUM-80a

LUM-80b

LUM-81

Shows that Egypt and North Africa continued during the Middle Ages “their tradition of leadership in science and mathematics, a tradition then already 4,000 years old”. Criticizes “most European historians (and North Americans)” who “have denied that Muslim scholars created anything new, merely crediting them with preserving Greek (European) learning during the Middle Ages” (p.1).

LUM-83a

“For thousands of years, Africa was in the mainstream of mathematics history. This history began with the first written numerals of ancient Egypt, a culture whose African origin has been reaffirmed by the most recent discoveries of archaeology. With a longer period of scientific work than any other area of the world, progress in mathematics continued on the African continent through three great periods, ancient Egyptian, Hellenistic and Muslim.” “Although all peoples and continents have played a role in the history of mathematics, the contributions of Africa are still unacknowledged by western historians.”

Reproduced in POW-97 with postscript (101-117).
LUM-83b

Novel about Egypt in the time of Hatshepsut (1500 BC) with information on ancient Egyptian mathematics (numerals, arithmetic, measurement, progressions).

LUM-83c

“The pyramids and other great monuments of Egypt and the Sudan are the product of a long development of African science and technology. Their development is traced from the mud brick beginning to the great pyramids and temples. Planning of the monuments is described; examples are given of written plans, and the level of mathematics and technology required for pyramid building are discussed. Possible methods of construction of the pyramids are considered.”

LUM-87

LUM-88

LUM-92a

New edition of LUM-79.

LUM-92b

Contains the several papers about African Americans in science, including ‘Benjamin Banneker’ (25-30) and about mathematics in Africa: ‘The Ancient Egyptians I’ (57-60), ‘The Ancient Egyptians II’
LUM-95a

LUM-95b
Booklet intended to motivate African-Americans to study mathematics. It explores “the African roots of modern mathematics” and explains “how math influenced the contributions and achievements of several African American in math-related careers” (p. 5).

LUM-95c
Part 1 (From Africa to the Arctic) includes the following chapters related to Africa: 1. Nubia (3-16); 2. Egypt (17-37); 4. Mozambique (44-52); 5. Kenya (53-61). Part 2 (Lives in Science and Math) includes the following chapters related to mathematics in Africa: Thomas Fuller (140-143) and Hypathia of Alexandria (144-149).
LUM-96

Describes the use of the rule of false positions in ancient Egypt, in the work of later Alexandrian mathematicians, like Diophantus (c. 250), and of Abu Kamil (born 850), the influence on mathematicians in Europe and later on Benjamin Banneker (1731-1806), one of the first African American who dedicated himself to mathematics.

LUM-02

Presents “examples from ancient construction and bookkeeping practices [which] indicate that the development of relatively modern concepts, such as recognition of zero as a quantity and the metricizing of space, has a long history, going back at least 4,700 years in ancient Egyptian mathematics. The examples include a bookkeeping balance sheet with many columns containing zero remainders and numbered construction lines at pyramids and mastabas. The same symbol, ‘nfr’, was used for the zero remainders and the zero reference point on the construction guidelines. A third example was a very interesting architect’s diagram that gave vertical coordinates for points located on a curve. The horizontal spacing of the points appears to be one cubit apart.”

LUM-03a

LUM-03b
2003b Lumpkin, Beatrice: Ancient Egyptian Mathematics and Forerunners: Some Hints from Work Sites, in: A. K. Eyma & C. Bennett (Eds.), *A Delta-man in Yebu*, Occasional Volume of
Hexagonal woven strip from Benin, Kenya, Mozambique, Nigeria (cf. GER-99a, p. 111)
MAD-86

MAEO-82

MAE-10

MAG-78

MAGI-02

MAH-98
Mathematics in African History and Cultures

MANC-90

MAN-86

Explains how the addition, multiplication and subtraction principles are used to form the Yoruba (Nigeria) numerals: 15 = 5 less 20, 40 = 20 x 2, 170 = (20 x 9) - 10, 185 = (200 - 10) - 5, 5000 = 200 x 25, etc. The author suggests that the origin of this system may be found in “the way in which large sums of money (cowries) are counted.”

MANO-65

MANO-77

MANO-79

MANO-84

MANO-85
1985 Al-Manouni, Mohamed: Mathematical study activities in Morocco of the fourth period of the Middle Ages (Merinid’s period), *Al-Manâhil*, Rabat (Morocco), No. 33, 77-115 (in Arabic).
MANO-89

MANS-98

A brief analysis of some philosophical passages in Books III and V of the *Mathematical collection* of Pappus of Alexandria and in Pappus’ commentary on Book X of Euclid’s *Elements*.

Review: HOGE-01.

MAP-96

Explores possibilities of using traditional Mozambican games and toys in mathematics education.

MAP-97

Translation into Norwegian of MAP-96.

MARC-88
1988 Marcos, Berthe Elisabeth: *Pédagogie de l'initiation aux mathématiques* [Pedagogy for initiation in mathematics], CEDA, Abidjan (Côte d’Ivoire), 72 p. (in French).

Didactical suggestions for preschool and early school mathematics teaching, using, in particular, games from the cultural environment of children in Ivory Coast.
Mathematics in African History and Cultures

MAR-64

MART-65
Report of an educational program in ten African countries (Ethiopia, Ghana, Kenya, Liberia, Malawi, Nigeria, Sierra Leone, Tanzania, Uganda, Zambia), being the African Mathematics Program (AMP) its first part. Contains the following contributions related to AMP:
* Onyerisara Ukeje: The Entebbe Mathematics Workshop, Summer 1962 (17-19),
* John Oyelese: The Entebbe Mathematics Workshop, Summer 1963 (20-24),
* Cyril Okosi: The Entebbe Mathematics Workshop, Summer 1964 (25-29),
* Stanley Weinstein: AMP, Tutor and Teacher Training Institutes (36-46).

MARTI-92
1992 Martinson, Annemarie: The role of rock art in mathematics education, University of Witwatersrand, Johannesburg (South Africa), 6 p. (mimeo).
Suggests that South African rock art may be explored in the mathematics classroom.

MAS-87

MAT-17
1917 Mathews, H.F.: Notes on the Nungu tribe, Nassawara Province, Northern Nigeria, and the neighboring tribes which use the duodecimal system of numeration, Harvard African Studies, Cambridge MA (USA), Vol. 1, 83-93 (Pages 92-93 are
Describes (pages 92-93) the numeration systems used by the Nungu and by neighboring peoples like the Ninzam on the north, the four clans known as the Artum, Barrku, Burrza, and Upye on the east, and the people known collectively as the Mada on the south.

MAT-64

MED-71

MEH-75
1975 Mehész, Kornél Zoltán: Secretos de la Matematica Egípcia, Griega y Hindu [Secrets from Egyptian, Greek and Hindu mathematics], Editorial Diogenes, Corrientes (Argentina) (in Spanish).

Deals mostly with mathematics from the Hellenistic period and links with other cultures, particularly with regard to cube roots, unsolved geometrical problems, and the regular pentagon.

MEI-15


MEI-17
1917 Meinhof, Carl: Rezension von K. Sethe ‘Von Zahlen und Zahlworten bei den alten Ägyptern und was für andere Völker und Sprachen daraus zu lernen ist’, Zeitschrift für Kolonialsprachen, Berlin (Germany), Vol. 8 (1917-1918), 268-270 (in German).
Review of SET-16. Sethe is criticized for the fact that he advances with a comparison with Semitic languages, but forgets to study the relationship with African languages.

MEI-23

Reconstructs and analyses a 7x7 magic square on a Hausa amulet (Nigeria), reproduced in C. Robinson’s ‘Specimens of Hausa-Literature’ (Cambridge, 1896). We are dealing with a bordered or concentric magic square: taking away the successive borders, the smaller squares remain magic. Meinhof calls it a Stifelius’ square after Michael Stifel, who discussed this type of magic square in his Arithmetica integra (1544).

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MEM-92

MERE-95
1995 Mereku, Kofi Damian: A comparison of the official primary mathematics curriculum in Ghana with the way in which it is implemented by teachers, doctoral thesis, University of Leeds (UK).

MEU-79
1979 Meunier, Dominique: Note sur la survivance des poids anciens à Tombouctou [Note on the survival of the old weights in Timbuktu], Revue d’histoire maghrébine, Zaghouan (Tunisia), Vol. 6, No. 15/16, 93-105 (in French).
MIC-96

Presents suggestions of how using ancient Egyptian fractions in the mathematics classroom.

MIC-99

MICH-74

Suggests two possible causes for poor achievement in mathematics in ‘black’ high schools in South Africa: the effects of differing cultural backgrounds, and the effect of the change of language medium from a mother tongue to English.

MID-97


MIL-92

The author conducted an ethnographic study as an apprentice carpenter in Cape Town, South Africa, to document the mathematical ideas that are embedded in the everyday woodworking activities of a group of carpenters.

MIZ-71
1971 Mizony, Michel: *Les jeux stratégiques camerounais et leurs aspects mathématiques* [Cameroonian strategic games and their
Presents a classification and regional distribution of strategic games from Cameroon and suggest that they be used “to understand many mathematical notions.”

MMA-65

Analysis of three foreign textbooks (algebra, arithmetic and geometry), in widespread use in Tanganyika (today Tanzania) schools in the early 1960’s. It shows how learning mathematics was made more difficult for African children by the cultural gulf between themselves and the authors of the books.

MMA-74
1974 Mmari, Geoffrey: *Tanzania’s experience in, and efforts to resolve, the problem of teaching mathematics through a foreign language*, UNESCO (ED-74/CONF.808/12), Paris (France).

Paper presented at the symposium ‘Interactions between Linguistics and Mathematical Education’ held in Nairobi (Kenya, 1-11 September 1974). Having decided to adopt (Ki)Swahili as the medium of instruction, Tanzania has been faced with the problem of enriching the language in order to be used in school mathematics education. The ways in which this is being tackled are described.

Reproduction in CASM-75, 32-43.

MMA-78

Analyses the history of mathematics education in Tanzania before and after Independence.
MMA-80

MMA-91

MOI-85

MOI-91
1991 Moiso, Bokula: Etude comparée du système de numérotation de 1 à 10 dans quelques langues non-Bantu du Haute-Zaïre [Comparative study of the system of numeration from 1 to 10 in some non-Bantu languages from Upper-Zaïre], *Annales Aequatoria*, Mbandaka (Congo / Zaïre), Vol. 12, 475-479 (in French).

MOR-70

MOS-96

Explores possibilities of using South African string figure patterns, games, architecture, flag, and counting methods in the classroom.
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MOS-97

MOS-98a

MOS-98b

MOS-00a
2000a Mosimege, Mogege David: The potential of the use of culturally specific games in school mathematics, doctoral thesis, University of the Western Cape (South Africa), 337 p.

Studies the potential of the use of culturally specific games, in particular, string figures, in secondary school mathematics classrooms in the North, West and the Northern Provinces of South Africa.

MOS-00b
2000b Mosimege, Mogege David & Lebeta, V.: An Ethnographic Study of Mathematical Activities at the Basotho Cultural Village, in: S. Mahlomaholo (Ed.) Proceedings of the 8th Conference of the Southern Association for Research in Mathematics and Science Education, University of Port Elizabeth, Port Elizabeth (South Africa).

MOS-02
Bibliography: M

Research in Mathematics, Science and Technology Education, University of Natal.

MOS-03

MPE-99
1999 Mpey-Nka, Richard Ngub’usim: La symbolique et la mystique du nombre ‘9’ chez le peuple Yansi traditionel [The symbolics and mystics of the number ‘9’ among the traditional Yansi people], Congo-Afrique, Kinshasa (DR Congo), No. 337, 417-434.

The number ‘9’ plays important ritual role in specific therapies and evokes fecundity. In order to analyze and understand the Yansi (DR Congo) symbolic system, the author starts with comparing it with numeric symbolisms from other cultures.

MPO-93

MTE-91

MTE-92a
Findings from an “exploratory study investigating beliefs about mathematics held by Zimbabwean secondary school students indicate that the students believe ‘traditional’ ethnomathematics exists; is legitimate mathematics; is the foundation upon which school mathematics expanded; but is too elementary, basic, and routine to be regarded as serious mathematics. Such beliefs, of course, need to be interpreted within the context of the student’s own epistemic worldview of mathematics as a form of knowledge.”

Text book designed and suitable for use as reference material for a teaching certification course for mathematics teachers.

“This paper draws from the views expressed by some Zimbabwean secondary school and in-service practicing teachers on a topic discussing some implications of students’ beliefs for learning and instruction. An important caveat that emerges from the discussion is that teacher preparation for school mathematics teaching should begin with an extensive consideration of the socio-epistemological aspects of mathematics as a cultural activity, rather than dwell exclusively on “methods of teaching” particular topics (the techniques) as is often the
practice, - if an overall goal is to empower learners through mathematics education. Students need to learn both mathematics and about mathematics.”

MTE-00b

MUB-88

The first part analyses oral and possible graphic numeration systems from Congo / Zaire. The second part deals with the symbolic expression of numbers in Luba cosmogeny (Congo / Zaire), e.g. the significance of even and odd, the use of ‘numbers of peace’: 4 and 12, 24, 48, 96... The author stresses that “the explanation of the origin of life by numbers [is] practically equal to that of Pythagoras” (p.153).

MUB-92a

The author intends to reveal “some scientific knowledge of the pre-colonial Bantu world” (p.91), in particular of numeration and geometric figures in the Great Zimbabwe civilization.

MUB-92b

Booklet on African architecture giving particular attention to shape and geometric form.
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MUE-69

MUE-81

MUE-91a

MUE-91b

MUG-1991

MUKA-71
1971 Mukarovsky, Hans G.: Die Zahlwörter “eins” bis “zehn” in den Mandesprachen [The numerals “one” to “ten” in the Mande languages], in: Six, V.; Cyffer, Norbert & Wolff, E. (Eds.), *Afrikanische Sprachen und Kulturen; ein Querschnitt*, Deutsches Institut für Afrika-Forschung, Hamburg (Germany), 142-153 (in German).

Compares the numeration in the Mande languages (West Africa) with that of the Cushitic languages.

MUK-02
MUL-53

MURA-89

MURA-92

MURR-84

MUS-87

Summarizes mathematics in daily life, measures, art, religion, etc. for the Hausa culture of northern Nigeria.

MWA-00
Example of a Kuba two-colour design (Congo)
(cf. GER-99a, p. 14)
NDI-95
1995 Ndigi, Oum: L’expression des cardinaux et des ordinaux en égyptien et en basaa [The expression of cardinal and ordinal numbers in Egyptian and in Basaa], *Discussions in Egyptology*, Oxford (UK), No. 33, 57-72 (in French).
Comparative study of numerals in Ancient Egypt and in the Basa language of Cameroon, also discussed in the author’s doctoral thesis *Les Basa du Cameroun et l’antiquité pharaonique égypto-nubienne: Recherche historique et linguistique comparative sur leurs rapports culturels à la lumière de l’égypotologie* [The Basa of Cameroon and Egyptian-Nubian Pharaonic Antiquity: Comparative historical and linguistic research on their cultural links in the light of Egyptology], Lyon, 1997.

NDI-03
2003 Ndigi, Oum: Notes sur la grammaticalisation du cardinal “un”, w^c, en égyptien ancien [Notes on the grammaticalization of the cardinal number “one”, w^c, in ancient Egyptian], *Cahiers Caribéens d’Egyptologie*, Martinique (France), No. 5, 179-185 (in French).

NEB-95
1995 Nebout Arkhurst, Patricia: *La signification contextuelle dans les processus de transposition didactique: l’exemple de l’enseignement de la géométrie au niveau du collège en Côte d’Ivoire* [The contextual signification in the process of didactic transposition: the example of the teaching of geometry at the high school level in Côte d’Ivoire], doctoral thesis, Université de Paris 5 (France) (in French).

NES-98
NEU-31

NEU-34

NEU-57

NEV-72

NEWC-81

NGC-91

NGUE-02
Describes the rationale and experience of the ‘Mathematics in the socio-cultural context’ (MESCA) workshop of the Mathematical Research Institute of Abidjan (IRMA, Côte d’Ivoire) with stimulating interest in mathematics by using various African verbal games as a preparation for mathematics education.

NHL-93
1993 Nhlengetfwa (Lafakudze), Thuli: The impact of elementary schools Maths / Science Inservice Teacher Education on the Manzini region (Swaziland) schools, doctoral thesis, Ohio University (USA).

NIANE-03
2003 Niane, Mary Teuw: La numération dans les langues nationales au Sénégal [Numeration in the national languages of Senegal], Université Gaston Berger, Saint-Louis (Senegal), 17 p. (in French).

Proposes a representation compatible with the way to express numbers in four national languages of Senegal (Joola, Pulaar, Sereer, and Wolof), spoken by more than 90% of the population.

NIA-71

NIAN-84

Two chapters of the first volume of this beautifully edited trilogy deal explicitly with mathematics of the Akan (Ghana, Côte d’Ivoire):
* Akan mathematical writing (250-269): The author explains how numbers, addition, multiplication and division are symbolically represented on the weights. He also analyses two series of monetary values. The first is decimal; the second has a binary structure (7 units, from 12 ba, 24 ba, .. to 384 ba ).
* Weights and the practical applications of geometry (270-277): The Akans constructed certain figurines in such a way that they
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represent signs, symbols and ideograms whether seen from in front or in profile.

NIC-77

NIC-68

The numbers four (*hudu*), three (*uku*) and seven (*bakwai*) play an important role in ritual, economic and social life among the Hausa in the Maradi valley (Niger). This role is described, analyzed and discussed.

NJO-76

NJO-79

NJO-85
Stresses that it is very urgent to study the history of mathematics in Africa, as colonialism and neo-colonialism neglected the existence of mathematics in Black Africa. “Pure mathematics is the art of creating and imagining. In this sense black art is mathematics.” The author gives a summary of the development of numeration systems, arithmetic and mathematical games in Africa.

NKH-05

NTA-97

NTE-04

Article arises from a study that investigates the benefits and forms of mathematical writing and written text produced by pupils in junior high schools in KwaZulu-Natal (South Africa).

NUL-80

Report of a workshop for science and mathematics teachers in Lesotho, convened to analyze problems faced in school by pupils who are learning in English, but whose mother tongue is Sesotho.

NYI-94
OAV-36

OBE-73

The author analyses the numeration system and arithmetics (including the use of fractions) and ‘cosmical numbers’ of the Mbosi (Congo) and makes a comparison with the mathematics of ancient Egypt.

OBE-74

OBE-90

Chapter 11 deals with mathematics (p. 355-427). It includes the following sections: Egyptian conception of mathematics; Knowledge of the technique of algebraic reckoning; The notion of Pharaonic mathematical logic; Metrology; Calculation of the area of a triangle; Calculation of the area of a circle; Surface of a semi-sphere; Calculation of the volume of the cylinder; Volume of a truncated pyramid; Calculation of the angle of inclination of a pyramid; Proof of the calculation of the angle of inclination of a pyramid.

Each section contains the reproduction of an Egyptian text, Obenga’s translation and his commentaries. The section on metrology includes a comparison with the measures and numeration used by the Duala (Cameroon), Fang (Cameroon, Equitorial Guinee, Gabon), Yoruba (Nigeria), Ganda, BaNgongo (Congo) among others. Also of interest
to the history of Mathematics is the chapter on Astronomy (265-301), with the following sections: Astronomical and geometrical orientation of buildings; Egyptian calendars. The last section includes a comparative description of Ancient Egyptian, Fang, Mbochi (Congo), Borana (Ethiopia) and Dogon (Mali) Astronomy.

OBE-95

This book by the Congolese linguist and Egyptologist Obenga, presents an overview of geometrical knowledge of ancient Egypt, stressing the relationship of this knowledge with know-how developed in other parts of Africa. He also underlines the influence of Egyptian geometry on the development of mathematics in ancient Greece, criticizing eurocentric views on the history of mathematics.

OCO-04

An introduction and bibliography.

OFI-97

OHU-73
OHU-75

Indicates the concepts of number with which children are expected to develop in the every-day activities of society, independently of formal schooling.

OHU-78

OIS-91
1991  Oiso, B.: Étude comparée du système de numération de 1 à 10 dans quelques Langues non-Bantu du Haut-Zaïre [Comparative study of the system of numeration from 1 to 10 in several non-Bantu languages from Upper-Zaïre], *Annales Aequatoria*, Mbandaka (DR Congo), Vol. 12, 475-479.

OJO-88

Describes the “frequent occurrence of the number 3 in African lore, making comparisons, where necessary with other world lore. Additionally the paper highlights the sacredness, mysticism, taboos, and superstitions attached to the number.”

OKO-70

OKO-71
“Attempt to replicate Piaget’s investigation of the development of geometric concepts among 358 children in Ankole district of Uganda where there are no traditional precision measuring instruments either geometric or others with a view to throwing some light on the extent to which schooling experience affected this development. The children’s understanding of three geometric concepts was investigated, the conservation of length, angular measurement and coordinate systems as indicated by the ability to locate a point in a rectangular sheet of paper.” “The findings do suggest that certain concepts of geometry may depend almost entirely on skills acquired through formal education and not on biologically based maturing logical structures of the child.”

OLA-77

OLIV-03


OLI-98

The proceedings contain the following contributions and abstracts, related mathematics and culture in Africa:

* Draisma, Jan: On verbal addition and subtraction in Mozambican Bantu languages, Vol. 2, 272-279;
* Mosimege, Mogege David: Culture, games and mathematics education: An exploration based on string figures (South Africa), Vol. 3, 279-286;
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* Mogari, David: Some geometrical constructs and pupil’s construction of miniature wire toy cars (South Africa), Vol. 4, 284;
* Soares, Daniel: On the geometry involved in the building of traditional houses with rectangular base in Mozambique, Vol. 4, 307;
* Mucavele, João: The mathakuzana game as a didactical resource for the development of number sense and oral arithmetic (Mozambique), Vol. 4, 345.

OMO-00

OMO-03a

OMO-03b

Discusses the Blombos stone (80 000 BC, South Africa), and the Lebombo (35 000 BC, Swaziland) and Ishango (20 000 BC, Congo) bones, and the ancient Nile civilizations Nubia and Egypt.

ONYU-96
1996 Onyumbe, Tshonga & Kabasele, Malumba: Mesures et poids aux marchés de Mbandaka [Measures and weights at the markets of Mbandaka], Annales aequatoria, Mbandaka (DR Congo), Vol. 17, 417-422.

Analyses the emergence of new measurement unities, smaller than the traditional ones, as a consequence of diminishing buying-power.
OPO-04

OSH-95

Short history of mathematics for teachers. Its references to Africa are to Ancient Egypt.

OTA-71

OYED-96

Examines the gender factor in seven common mathematics textbooks used in Nigerian secondary schools. Significant differences were found on the number of items and illustrations that were male or female related, to the detriment of females.

OYE-99
PAG-87

“Forty objects of African art, mostly from the Yoruba (Nigeria) are analyzed in function of the involved repetitions. The twofold objects evoke the most usual dichotomies: good/bad, life/death; the threefold objects evoke sometimes a hierarchy; the fourfold objects may be associated with the directions in space” [summary reproduced from: Afrique Contemporaine, Paris (France), 1989, No. 149, p. 94].

PAL-90

PAN-69

PAP-83

Revises conventional assumptions about the role of Africans in the history of physics by outlining some of their contributions to measurement, mechanics, optics, astronomy, and metallurgy.

PAPP-82
Bibliography: P

PAPP-86

PAR-72
Publication and analysis of five mathematical papyri from Hellenistic Egypt.
Review: WAE-74.

PAS-94

PAT-90
Criticizes an article by H. Beckers [1988] in the same journal, in which it is asserted that Augustine (354-430), bishop of Hippo (North Africa), warned that “good Christians should beware of mathematicians, because the danger exists that they have made a pact with the devil.” On the contrary says the author Augustine warned against astrologers: the Latin ‘mathematicus’ also means astrologer. Augustine considered geometry and arithmetic as useful disciplines.

PATE-03
Explores “the presence of symmetry in patterns on Swazi grass mats made by women in Swaziland. The fundamental aim is to elucidate and present basic explanations of the presence of symmetry in the patterns on the Swazi grass mats. … Symmetry in patterns on other
parallel Swazi material culture that admits patterning in clay beer pots, beaded necklaces, grinding mats and more recently baskets…” are illustrated.

PAU-71

Presents a classification of games that presuppose a high level of mental concentration.

PEE-23

PEE-31

PER-84

PETER-99

PETE-84
The following topics deal with Africa: Egyptian numerals, Oware game, Egyptian multiplication, “Nine Men’s Morris”, African string puzzle, Egyptian rope stretchers, Shongo networks.

PET-78
1978 Petitto, Andrea: Knowledge of arithmetic among schooled and unschooled tailors and cloth merchants in Ivory Coast, doctoral thesis, Cornell University, Ithaca NY (USA).

PET-82a

Study of the transfer of mathematical problem-solving ability among adult unschooled Dioula tailors and cloth merchants in Ivory Coast.

PET-82b

Comparative study of the mental arithmetic abilities among unschooled Dioula adults (Ivory Coast) and USA college students. “Both groups showed accurate mental arithmetic strategies related to the base ten structure of their native counting systems.”

PETR-71
1971 Petracek, Karel: Die Zahlwörtersysteme der zentral-saharanischen Sprachen [The numeral systems in the central-Saharan languages], in: Six, V.; Cyffer, Norbert & Wolff, E. (Eds.), Afrikanische Sprachen und Kulturen; ein Querschnitt, Deutsches Institut für Afrika-Forschung, Hamburg (Germany), 246-252 (in German).

PHY-71
Examines the way in which the principle of *kujitegemea* (Swahili expression for ‘self-reliance’) is being applied in the development of school mathematics.

PIE-79

PLE-99

PLO-50

POS-79

POS-78

POS-82

Investigates the development of mathematical concepts among children from two groups in central Ivory Coast, an agricultural population (Baoule) and a merchant society (Dioula). “The advancement of quantitative understanding appears to be dependent on
certain kinds of experiences which both schooling and a merchant culture afford.”

POW-97a

The following chapters or parts of them relate to mathematics in Africa:

* Martin Bernal: Animadversions on the origins of western science (83-99) [originally 1992]:
  Presents “arguments for the existence of rich mathematical – particularly geometrical – and astronomical traditions in Egypt by the time Greek scholars came in contact with Egyptian learned priests” (p. 95);
* Reproduction of LUM-83 with postscript (101-117);
* Herbert Ginsburg: The myth of the deprived child (129-154) [originally 1986 with postscript]:
  Includes references to the author’s research on the development of mathematical thinking among the Dioula and Baoulé (Côte d’Ivoire);
* Reproduction of GER-88c (223-247);
* Claudia Zaslavsky: World cultures in the mathematics class (307-320) [originally 1991];
* Paulus Gerdes: Survey of current work on ethnomathematics (331-371) [originally 1993].

POW-97b

Presents a biographical sketch of the Egyptian born Caleb Gattegno (1911-1988), who moved in 1945 to Europe and later to the USA.

POW-07
PRE-93

Describes “the attitudes of students in a multiracial school in South Africa about the interplay between their different cultures and mathematics. The school is deliberately multicultural. Students still experience language problems, but seem to enjoy the mathematics more when it is related to their everyday experiences.”

PRU-86

Includes examples of the use of magic squares.

PTO-88

Reprint of the translation of Ptolemy of Alexandria’s *Mathematical Composition* by Abby Halma published in 1813 and 1816 with notes by Delambre (Ptolemy = Claudius Ptolemeus, c. 85 – c. 165).

PYE-93

Section 2.4 “Algeria: The Overseas projection of Metropolain Terrain” (87-127), section 2.5 “Tunisia and Morocco: The Antebellum Satrapies (128-154), and section 3.7 “Lebanon and Madagascar: Peripheral Territories” (207-240) deal with French colonial policy towards mathematics and the natural sciences in Africa.
RAM-89

RAS-68

RAS-74

RAS-75

RAS-78
1978 Rashed, Roshdi: Lʼextraction de la racine nième et lʼinvention des fractions décimales (XIe-XIIe siècles) [The extraction of the n\textsuperscript{th} root and the invention of decimal fractions], *Archive for History of Exact Sciences*, Berlin (Germany), Vol. 18, No. 3, 191-243 (in French).

RAS-79
Mathematics in African History and Cultures

RAS-80

RAS-81

RAS-84


Translation: RAS-94.

RAS-89

RAS-91a

Contains the papers FED-91, MUE-91, and RAS-91b.

RAS-91b
The author analyses certain aspects of the contents of two works of the 11th century mathematician Ibn al-Haytham, entitled Maqāla fī t-tahlīl wa tarkīb (Book on Analysis and Synthesis) and Kitāb al-ma‘lūmāt (Book of the Known). The paper is concluded by an appendix that contains the French translation of the introduction by Ibn al-Haytham to his Book on Analysis and Synthesis (150-162).

RAS-92

RAS-93

RAS-94a

Updated translation of the RAS-84.

RAS-94b

RAS-96

Volume 2 includes the following chapters includes the following chapters: Numeration and Arithmetic (A. Saidan); Algebra (R.
Rashed); Combinatory analysis, Numerical analysis, Diophantine analysis and number theory (R. Rashed); Geometry (B. Rosenfeld, A. Youschkevitch); Trigonometry (M. Debarnot); The influence of Arab mathematics in the medieval West (A. Allard); Music science (J. Chabrier); Statics (M. Rozhanskaya); Geometrical optics (R. Rashed); The emergence of physiological optics (G. Russell); The Western reception of Arab optics (D. Lindberg).

RAT-91

Presents suggestions for the use of African games and drawings and some ideas from Ancient Egypt in mathematics classrooms.

RAU-38

The book is addressed to those responsible for teaching arithmetic to speakers of Bantu languages. The author suggests, “for teaching the African child to handle the system of numbers and to carry out operations in it, tribal activities, both adult and juvenile, with numerical bearing, are the most suitable media”. Several examples of such activities, including games, are given. Furthermore, he suggests, “if generalizations and abstractions are to be acquired by the pupils as lasting instruments of thought, advanced arithmetical processes must be developed from the numerical problems of their own cultural background.” Presents examples mostly from South Africa and Tanzania.

REB-88
1988 Rebstock, Ulrich; Rainer Osswald & Abdalqadir Wuld: Katalog der arabischen Handschriften in Mauretanien [Catalogue of Arabic manuscripts in Mauritania], F. Steiner Verlag, Wiesbaden (Germany), 160 p. (in German and Arabic).

Contains a catalogue of Arabic manuscripts in Mauritania, including some repertories on mathematics.
REB-89
1989 Rebstock, Ulrich: *Sammlung arabischer Handschriften aus Mauretanien: Kurzbeschreibungen von 2239 Handschrifteneinheiten mit Indices* [Collection of Arabic manuscripts from Mauritania], O. Harrassowitz, Wiesbaden, 278 p. (in Arabic; prefatory material and notes in German).

The catalogue includes mathematical manuscripts.

REB-92
1992 Rebstock, Ulrich: *Rechnen im islamischen Orient* [Calculation in the Islamic East], Wissenschaftliche Buchgesellschaft, Darmstadt (Germany), 328 p. (in German).

Discusses the different methods of calculation used in the Arab mathematical tradition from the East (arithmetic, algebra, heritage, land measuring, metrology, etc.), with many references to the Arab mathematical tradition of the Maghreb.

REB-95

RED-06

REDJ-77
REH-82

REI-82

REI-87
1987 Reineke, Walter-Friedrich: Gedanken und Materialien zur Frühgeschichte der Mathematik in Ägypten [Thoughts and materials on the early history of mathematics in Egypt], doctoral dissertation, Humboldt University, Berlin (Germany) (in German).

REN-32

REN-33

REN-37

REN-38a

REN-38b

REN-41

REN-42

REN-44

REN-45
REN-48

REY-98
1998 Reyes García, Ignacio: *Estudio Etnolingüístico de los antiguos numerales canarios* [Ethnolinguistic study of the ancient Canarian numerals], Baile del Sol, Tenerife (Canary Islands, Spain), 120 p. (in Spanish).

This study is a philological analysis of the transmitted names of some cardinal numbers of the old Canarian numeration system. It combines a linguistic, ethnological and historic focus.

RIN-03

RIS-74

RIT-89

The paper contains a comparative study of the Babylonian and Egyptian computing techniques as they appear in the documents that survived.

Translation: RIT-95

RIT-93
1993 Ritter, James: *Pratique de la raison en Mésopotamie et en Egypte au IIIe et IIe millénaires* [Praxis of reasoning in Mesopotamia and Egypt during the 3rd and 2nd millennia],


RIT-95

Translation of RIT-89.

RIT-00

The paper is structured in the following sections: Sources, Writing and Metrology, the Mathematical Texts, Fractions and Tables, Notes, Bibliography.

RIT-03

ROB-85

“Deals with the trigonometric basis of pyramid architecture and disposes of the erroneous notion that pyramidal dimensions intentionally incorporate irrational numbers.”

ROB-87
Review: BRU-90b

ROB-94
1994   Robins, Gay: Proposition and Style in Ancient Egyptian Art, University of Texas Press, Austin (USA), 279 p.

“It has long been known that much Egyptian art executed in two dimensions as painting or relief was conceived and carried out on a squared grid, which helped to determine the proportions of the human figure. Although there have been several previous studies of the Egyptian grid, these have been almost entirely limited to single standing or seated male figures... In this book I have attempted to base my own ideas ... primarily on observations carried out on the actual monuments. I have considered female figures as well as male, other postures besides standing and sitting... I show that the squared grid had an important influence on the composition of scenes as a whole and in helping to determine the characteristic style of a particular period. I consider the effects of the major change in the grid that occurred in the twenty-fifth dynasty and persisted thereafter, and elaborate my discovery of the grid system adopted during the Amarna period” (Preface, p. vii).

ROE-94

ROI-93
1993   Roik, Elke: Das Längenmaßsystem im Alten Ägypten [The system of length measurement in ancient Egypt], Christian-Rosenkreutz-Verlag, Hamburg (Germany), 404 p. (in German).

Review: LEG-94

ROSE-76

ROS-01
Bibliography: R

ROS-02

“The Fibonacci series and the Golden Section have often been used to explain the proportions of ancient Egyptian art and architecture. All such theories, however, are based on our modern mathematical system. They have never been examined in the realm of ancient Egyptian mathematics, as we understand it from studying the surviving mathematical sources. This article analyses the compatibility of the Fibonacci series with ancient Egyptian mathematics and suggests how an ancient scribe could have handled it. The conclusion is that concepts such as φ and the convergence to φ have little in common with the surviving ancient Egyptian mathematical documents and that they are quite far from the ancient Egyptian mentality” (p. 101).

ROS-04

ROU-97

The object of this paper is to determine the mathematical contribution of Ribaucour during his Algerian stay (in particular, his conflict with Gaston Darboux).

RYA-78

Describes how a teacher made measurement more meaningful to children in an African village school by using local examples.
SAB-97

Presents a criticism of R. Rashed’s hypothesis that works attributed to Ibn al-Haytham are actually the result of the confusion of two different historical characters, one a mathematician and the other a physician.

SAI-84

Contains the edition of the arithmetical book, entitled “The four epistles” of the Maghrebian mathematician Ibn al-Bannâ (d. 1321).

SAI-86

SAID-98

SAIT-85

SAIT-86
1986 Saito, Ken: Compounded Ratio in Euclid and Apollonius, Historia Scientiarum, Tokyo (Japan), No. 31,25-29.
SAIT-93

SAIT-94

SANC-43
1943  Sanchez Pérez, José Augusto: *La aritmética en Babilonia y Egipto* [Arithmetic in Babylonia and Egypt], Consejo Superior de Investigaciones Científicas, Madrid (Spain), 72 p. (in Spanish).

SAN-60

Paper on the numerals, arithmetical operations, measures, coins, time reckoning, and geometrical vocabulary of the Cokwe of North-East Angola.

SANZ-98

SAWY-70
Discusses “the significance and incidence of the use of the figure three to symbolize female activity, and of the figure four to symbolize male participation among the Mende” (p. 30).

SCHE-98
1998 Scheerder, Jeroen & Renson, Roland: *Annotated Bibliography of Traditional Play and Games in Africa*, International Council of Sport Science and Physical Education (ICSSPE), Berlin (Germany).

SCHI-96

SCHM-98

SCH-15

In the first part an overview and comparative analysis of counting systems in Sub-Saharan Africa is given. The second part deals with psychological and historical factors that influence the development of counting (systems).


SCHW-79

SCHW-85
1985 Schweigman, Caspar: *Operations research problems in agriculture in developing countries*, Tanzania Publications
The books SCHW-79 and SCHW-85 present applications of linear programming in developing countries, giving, in particular, examples from Tanzania and the Sahel.

SED-34

This is the partial translation into French of the important astronomical treatise of the Maghrebian mathematician from the 13th century Abû l-Hasan al-Marrâkushî. The translation has been realized by Jean Jacques Sédillot and published by his son Louis Amélie. This treatise includes the description and the utilization of a whole series of astronomical instruments used in the countries of Islam between the 9th and the 13th century. The Arabic manuscript of al-Marrâkushî was published in facsimile [ed. F. Sezgin, I.G.A.I.W., Frankfurt (Germany), Series C 1, 1984, Vol. I, p., Vol. II, 376 p.].

SEG-01

SEI-59

“The almost universal stem for 3 in Bantu is -tatu, or a variant, in particular -datu. In the northeast the dominant form for 6 is -tandatu. It has been asserted that -tandatu is a duplication of -datu. This etymology is rejected. Instead the etymology -tandatu = 5+3 is suggested. Evidence is presented to show that -tandatu was originally in position 8 but then fell into position 6.”
In a previous article it was argued that the Eastern Bantu stem -tandatu for six originally meant 8, but later fell into position six. In the argument, the -tan of -tandatu was compared with the Bantu stem -tano for five. To this it has been (validly) objected that the t of -tano is of the palatal variety whereas the t of -tanda is not. The proposed comparison with -tano is abandoned, but the rest of the thesis maintained.

The word kumi (root km) is nearly universal as the word for 10 in the Bantu languages. In Africa, the equations km = 1, km =10 and km = 100 all occur. In Bantu, kumi = 10, kama = 100. Keme =1 occurs in Bagrim-ma. Keme = 100 occurs to the far west (Mande), e.g. kome = 1 occurs in Ga (Ghana). The author relates the km root to the ancient Indo-European sound dekm for ten and suggests a common origin. Also examples from other continents are given.

Text of a paper presented at the Annual General Meeting of the Mathematics Association of Tanzania (May 1986). It describes the development of the mathematics curriculum in Tanzania since Independence. A distinction between three periods is made: “the traditional mathematics era, the modern era and the present era, which lends from both traditional and modern mathematics.”
SEK-93a

SEK-93b
1993 Seka, Beniel: *Kipeo na Kipeuo Mahakamani* [Kipeo (root) and Kipeuo (square) together], Dar Es Salaam University Press, Dar es Salaam (Tanzania), 22 p. (in Swahili).

SEK-93a and SEK-93b are children’s booklets that use the traditional story telling pedagogy to introduce and discuss mathematical ideas: the introduction of 0 in the first booklet, and of squares, square roots and the Pythagorean Proposition in the second.

SEL-97

The following papers relate to the history of mathematics in Africa:
* Jacques Sesiano: Abu Kamil (4-5);
* Laurance Doyle & Edward Frank: Astronomy in Africa (96-100);
* Jehane Ragai & Gregg de Young: Calendars in Egypt (167-168);
* Ahmed Djebar: Combinatorics in Islamic mathematics (230-232);
* Jan Hogendijk: Conics (235-236);
* Bala Achi: Construction techniques in Africa (236-240);
* Marcia Ascher: Ethnomathematics (326-330);
* Paulus Gerdes: Geometry in Africa: Sona Geometry (367-368);
* Emilia Calvo: Ibn al-Bannâ (404);
* Rosdi Rashed: Ibn al-Haytham (Alhazen) (405-408);
* Ahmed Djebar: Ibn Al-Yâsamîn (414-415);
* Ahmed Djebar: Ibn Munâkim (427-428);
* Yousouf Guergour: Ibn Qunfudh (428-429);
* Jacques Sesiano: Magic squares in Islamic mathematics (536-538);
* Thomas Bassett: Maps and mapmaking in Africa (554-558);
* Paulus Gerdes: Mathematics in Africa: South of the Sahara (611-613);
* Ahmed Djebar: Mathematics in Africa: The Maghreb (613-616);
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- Salimata Doumbia: Mathematics in West Africa: Traditional mathematical games (616-619);
- James Ritter: Mathematics in Egypt (629-632);
- Jens Hoyrup: Practical and recreational mathematics (660-663);
- Lawrence Robbins: Namoratunga [archaeoastronomical site] (755);
- Paulus Gerdes: Numeration systems in Africa (781-784);
- Gregg de Young: Pyramids (828-829);
- Ahmed Djebbar: Al-Qalasâdî (830-832);
- Georges Niangoran-Bouah: Weights and measures in Africa: Akan gold weights (1005-1007);
- Ruth Willard: Weights and measures in Egypt (1012-1014).

SEL-00

Concerning Africa, the book contains the papers GER-00e, RIT-00, SES-00 and VERR-00.

SELW-78

SER-83

Contains among other papers: LUM-83a, LUM-83c, PAP-83, 3-ADA-83a, 3-ADA-83b, 3-LYN-83.

SES-77
Bibliography: S


1989 Sesiano, Jacques: *Koptisches Zahlensystem und (griechisch-)koptische Multiplikationstafeln nach einem arabischen Bericht* [The Coptic number system and Greek-Coptic multiplication tables as described in a short Arabic account], *Centaurus*, Copenhagen (Denmark), Vol. 31, 53-65 (in German).

Analyses a 15th century work devoted to presenting the old Coptic numeral system that used 27 Coptic letters to abbreviate calculations.


General construction methods of magic squares appeared in the countries of Islam in the 9th century, and the science of magic squares arrived there at its zenith in the 11th and 12th centuries. From the 13th century, magical and divinatory applications began to replace of mathematical study. Classical construction methods survived, however, in later treatises of a certain level, as in part of a work by Muhammad ibn Muhammad al-Fullani al-Kishnâwî (born in the north of Nigeria and died in Cairo in 1741), on the construction of magic squares of odd order. It is this chapter of the book of al-Kishnawi that is analyzed in the paper. In relationship to the contents of the chapter, the author of the paper states “We find here the explanation of different ways of disposing the numbers in the squares, and with diverse forms of magic. Although the majority of these constructions are already known from the classical period, they are often explained or applied in an easier way; time has, to a certain degree, served as a filter, and the reported methods are those whose use has been preserved by their simplicity or elegance. One finds also, at the end of the extract, the explanation of a topic that is new in relation to classical treatises (without doubt due to its magic use): that of magical squares of which one square is left unoccupied. All topics are presented by al-
Kishnâwî with great clarity. He certainly seems to be a person of worth: the biographical note dedicated to him by the historian al-Jabartî (1753-1825/6) in his *Chronicles* (Al-Jabartî 1888-89, II, 39-42) are full of praise for his capacities and merits. Al-Kishnâwî seems even to have been the authority in the new field of squares with holes, as he is mentioned elsewhere by the same al-Jabartî in relation to the properties of those squares of order 5.”

A magical square in a manuscript of Al-Kishnâwî (vf. SES-94)

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**SES-96**

**SES-00**
2000  Sesiano, Jacques: Islamic mathematics, in SEL-00, 137-165.

The paper contains the following sections: Heritage (Mesopotamian, Indian, Greek), Arithmetic (reckoning, root extraction), Algebra (algebraic reckoning, geometrical illustration, other), Geometry (regular polygons [including Abû Kâmil], cubic equation, other), Number theory, and Magic Squares [including Ibn al-Haytham].

**SETA-02**

**SET-16**
1916  Sethe, Kurt: *Von Zahlen und Zahlworten bei den alten Ägyptern und was für andere Völker und Sprachen daraus zu
lernen ist. Ein Beitrag zur Geschichte von Rechenkunst und Sprache [About numbers and number words among the Ancient Egyptians and what can be from them concerning other peoples. A contribution to the history of arithmetic and language], Trübner, Strassburg, 147 p. (in German).

SEZ-97a


SEZ-97b


SEZ-97c
The first volume on Euclid contains papers by Franz Woepcke (1-31, in French); Ludwig Oftendinger (33-52, in German); Moritz Steinschneider (54-128, in German); Maximilian Curtze (129-134, in German); Hermann Weissenborn (135-160, in German); Antonio Favaro (161-186, in Italian); Johann Ludwig Heiberg (187-271, in German); Martin Klamroth (272-328, in German).

SEZ-97d

The second volume on Euclid contains papers by Rasmus O. Besthorn (1-2, in German); Heinrich Suter (3-110, in German); Mansion (111-113, in French); Karl Lokotsch (115-141, in German); Raymond Archibald (143-236); Giuseppe Furlani (237-287, in German); Eilhard Wiedemann (288-296, in German); and Gotthelf Bergsträßer (297-324, in German).

SEZ-97e

The third volume on Euclid contains papers by David Smith (1-6); Albert G. Kapp (8-121, in German); M.-A. Kugener (122-124, in French); Claire Baudoux (125-129, in French); Gustav Junge (131-147, in German); Clemens Thaer (148-163, in German); A. S. Ünver (164-166); Edward B. Plooij (167-243); Marshall Clagett (244-270); and Abdalhamid Sabra (272-309, in Arabic).

SEZ-97f
Goethe University, Frankfurt am Main (Germany), Collection “Islamic mathematics and science”, Volume 23, 262 p.

The volume on Abû Kâmil (Egypt) contains papers by Gustavo Sacerdote (Pentagon and decagon, 1-26, in Italian); Heinrich Suter (Pentagon and decagon; 27-54; Arithmetic, 56-76, in German); Louis Karpinski (Algebra, 78-106); and Josef Weinberg (Algebra, 107-251, in German).


This volume on Ibn al-Bannâ (Morocco) contains papers by Aristide Marre (1-56, in French); Franz Woepcke (57-138, in French); Michel Chasles (139-147, in French); Moritz Steinschneider (149-150, in French); Giorgio Levi Della Vida (151-156, in Italian); Henri-Paul-Joseph Renaud (158-300, in French, reproduction of REN-37, REN-38a, REN-44, REN-48).


The first volume on Ibn al-Haytham (Egypt) contains papers by Louis-Amélie Sédillot (1-24, in French); Moritz Steinschneider (25-60, in Italian and French); Marcus Baker (61-65); Paul Bode (66-110, in German); Heinrich Suter (111-184, in German); Michael Jan de Goeje (168-188, in French); Eilhard Wiedemann (189-273 and 313-351, in German); and Johan Ludvig Heiberg & Eilhard Wiedemann (275-311, in German).
The second volume on Ibn al-Haytham (Egypt) contains papers by Eilhard Wiedemann (1-9, in German); Carl Schoy (11-93, in German); Karl Kohl (94-228, in German); Armand Abel (230-235, in French); Roberto Marcolongo (237-251, in Italian); José Maria Millás Vallicrosa (253-282, in Spanish); Henry J. Winter & W. Arafat (283-314); and Hâmid Dilgan (315-323, in French).

Highlights of some Muslim contributions to the development of algebra (8\textsuperscript{th} – 16\textsuperscript{th} centuries) are pointed out: solution of quadratic, cubic and biquadratic equations, addition theorem of exponents, numerical approximation, introduction of algebraic symbolism, binomial theorem.
SHI-86a

Discusses the “problem of making the history of mathematics culturally relevant in the Nigerian setting when much of the recorded historical developments in mathematics have been Mediterranean, Arab and European.”

SHI-86b

“Although the value of studying and teaching the history of mathematics is clear, the European-centred content of standard history of mathematics may make it less relevant to African students.” As a response, it is necessary to use ‘a wider scope of mathematics; not simply the standard ‘learned mathematics’, but mathematics in daily life and culture, the so-called ‘ethnomathematics’.”

SHI-88a

Paper presented at the 6th International Congress on Mathematics Education, Budapest. It gives an overview of studies on traditional Nigerian, arithmetical algorithms and suggested that such techniques could be used in classrooms as alternative algorithms: “... children might relate mathematics better to their home culture, by seeing techniques from their own traditional society being applied in the setting of their mathematics classroom.”

SHI-88b
Mathematics in African History and Cultures

SHI-95

Includes suggestions from Africa (e.g. Mancala games, Adinkra textile patterns).

SHI-96
1996 Shirley, Lawrence: Activities from African Calendar and Time Customs, Mathematics Teaching in the Middle School, NCTM, Reston VA (USA), Vol. 1, No. 8, 616-620.

Presents suggestions of how using African “day-names” (examples are given from Ghana and Nigeria), and practices like the “sunrise clock” in the mathematics classroom.

SIC-05

Contains the following contributions:
* Aderemi Kuku: Mathematical sciences and the development of Africa, 9-16;
* Saliou Touré: La situation mathématique en Afrique [The mathematical situation in Africa], 17-24 (in French);
* Norbert Hounkounnou: Mathematics from Africa: Status, goals and responsibilities, 25-34;
* Nithaya Chetty & Ahmed Bawa: Developing computational mathematics in Africa, 35-52;
* Edward Lungu: Status of mathematics in Sub-Sahara Africa, 53-62;
* Kgomotso Garegae: Mathematics in different cultures and societies: the Botswana case, 63-82;
* Paulus Gerdes: Mathematical research inspired by African cultural practices: the example of mirror curves, Lunda-designs and related concepts, 83-100;
SIMK-05

SIMO-92

SIMO-94

SIM-98
1998 Sims, John: *Designs from the Kuba (Congo) and the teaching of mathematics to arts students*, paper presented at 76th Annual Meeting of the National Council of Teachers of Mathematics (2-4 April 1998, Washington DC, USA).

SIZ-99

SMI-82

Addresses the question ‘Why did the Egyptians build pyramids using angles of elevation of approximately 43 1/2 or 52 degrees?’

SMIT-88
SMIT-96

SMIT-99

SMITHJ-92

SOA-91

SOA-96
1996 Soares, Daniel: The incorporation of the geometry of traditional house building in mathematics education in Mozambique, in: T. Kjaergard et al. (Eds.), *Numeracy, Race, Gender, and Class — Proceedings of the Third International Conference on the Political Dimensions of Mathematics Education*, Gaspar Forlag, Landas (Norway), 242-244.

Suggests the use of the geometry of house building techniques in mathematics education.

SOA-05
2005 Soares, Daniel: A construção de casas tradicionais e a resolução de problemas [The construction of traditional houses and problem solving], *Matemática & Educação*, Beira (Mozambique), No. 1, 32-35.

SOA-06

Describes popular ways in the Sofala and Zambeze provinces of
Mozambique to construct the rectangular base of a traditional house.

SOA-07
2007 Soares, Daniel: *The incorporation of the geometry involved in traditional house building in Mathematics Education in Mozambique. The cases of the Zambezia and Sofala Provinces*, doctoral thesis, University of the Western Cape, Rondebosch (South Africa).

SOU-69

SOU-72

SOU-73

SOU-75

Paper presented at the International Congress of Mathematical Sciences, (Karachi, 14-20 July 1975), including a translation of a manuscript of Ibn al-Bannâ (1256-1321, Maghreb) on perfect, abundant, deficient and amicable numbers.

SOU-76
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Arabic version of SOU-75.

SOU-82a

Analyses the treatise “Summary of principles and conclusions” by the Moroccan astronomer al-Hasan al-Marrâkushî (13th century). This treatise may be considered the culmination of astronomic literature written in Arab. It gives a summary of the results obtained by al-Hasan’s predecessors and adds his own observations and solutions.

SOU-82b

Arabic version of SOU-82a.

SOU-83a

SOU-83b

SOU-84
SOU-88a

SOW-92

SSE-97

Overview of the development of mathematics at the Makerere University since its creation in 1922; brief information on the Uganda Mathematical Society established in 1972 under the leadership of Paul Mugambi – “the grandfather of mathematics in the country” (p.30).

STA-67

Compares the prefixes used in the Bantu languages in connection with the cardinal numbers one to five. The paper analyses also ‘abstract’ counting (i.e. without reference to the objects), and ‘distributive’ (‘two by two’,...) and ‘multiplicative’ use of cardinals in the Bantu languages. Maps with information on the geographical distribution are included.

STEE-02
2002 Steele, John M. & Annette Imhausen (Eds.): *Under one sky: astronomy and mathematics in the ancient Near East*, Ugarit-Verlag, Münster (Germany), 496 p.

STE-77
1877 Steinschneider, Moritz: Rectification de quelques erreurs relatives au mathématicien arabe Ibn al-Bannâ [Rectification of some errors concerning the Arab mathematician Ibn al-Bannâ], *Bulletino di Bibliografia e di Storia Delle Scienze Matematiche*
Mathematics in African History and Cultures

*e Fisiche (Boncompagni)*, Rome (Italy), Vol. 10, 313-314 (in French).

STEV-98

STO-93

Presents suggestions about the use of baskets, hair braiding, and weaving designs in mathematics education.

STR-30
1930 Struve, V. V.: *Mathematische papyrus des Staatlichen Museums der Schönen Künste in Moskau* [Mathematical papyrus in the State Museum for Beautiful Art in Moscow], Springer Verlag, Berlin (Germany) (in German).

SUS-05

SUT-00
1900 Suter, Heinrich: *Die Mathematiker und Astronomen der Araber und ihre Werke* [The mathematicians and the astronomers of the Arabs and their works], Teubner, Leipzig (Germany), 277 p. (in German).

SUT-01
1901 Suter, Heinrich: *Das Rechenbuch des Abû Zakariyâ* [The arithmetic book of Abû Zakariyâ], *Bibliotheca Mathematica*, Halle (Germany), Series 3, No. 2, 12-40 (in German).
SUT-10
1910 Suter, Heinrich: Das Buch der Seltenheiten der Rechenkunst von Abû Kâmîl el-Misrî [The book of the particularities of the art of reckoning by Abû Kâmîl el-Misrî], Bibliotheca Mathematica, Halle (Germany), Series 3, No. 11, 100-120 (in German).

SWI-56

SZA-90
TAF-87

“… certain numbers [e.g. 2, 4, 40, 44, 80, 7] in the Semitic languages of Ethiopia form components of idiomatic expressions in which they lose their accurate mathematical significance and assume figurative meanings, or connotations which have no relation whatsoever to their original meaning. Some imply greatness, wholeness or totality; others indicate excessiveness of amount, or fantastical size” (p. 92).

TAH-95

TAIS-82

TAIS-96

TAIS-03
2003 Taisbak, Christian Marinus: *Euclid’s Data or the importance of being given*, Museum Tusculanum Press, University of Copenhagen, Copenhagen (Denmark), 271 p.

TAI-75

The Yoruba Project extended the use of the Yoruba language as the medium of instruction in certain schools in Western Nigeria to the end
of primary school. Problems faced by the writers of the mathematics material are discussed, with examples of proposed solutions.

TAR-87

TCH-94

Discusses traditional numeration in “àjá” (Benin) and possibilities of and experimentation with a decimalization.

TEM-38
1938 Tempels, Placidus: De tel-gebaren der Bashila [The number-gestures of the Bashila], Congo-Overzee, Antwerpen (Belgium), Vol. IV, No. 2, 49-53 (in Dutch).

Describes the number-gestures among the (Ba)Shila in Congo / Zaire. There are two series, one for counting from 1 to 10, and one for indicating individual numbers (cardinal numbers).

THA-33
1933 Thaer, Clemens: Die Data von Euklid nach Heibergs Text aus dem Griechischen übersetzt [The Data of Euclid according to Heiberg’s Text translated from the Greek], Springer, Berlin (Germany), 78 p. (in German).

THA-62
1962 Thaer, Clemens: Die Data von Euklid nach Menges Text aus dem Griechischen übersetzt [The Data of Euclid according to Menges Text translated from the Greek], Springer, Berlin (Germany), 78 p. (in German).
THEI-78

THEI-84

THE-90

THE-93
1993 Theon of Alexandria: *Commentaire sur les Livres I et II de la Syntaxe mathématique de Ptolémée* [Comments on the Syntax of Ptolemy (Greek text with French translation by Halma)], Blanchard, Paris (France), 461 p. (in French).

THO-20

About duodecimal systems of numeration in Nigeria.

THOM-87

THOM-92a

Analyses traditional methods of food processing, cassava-processing technology, textile technology, and pedagogy and science teaching in Nigeria. The text concentrates on the historical dimension but
approaches the subject in the context of multidisciplinary interpretation. The book includes KANI-92a.

THOM-92b
1992b Thomas-Emeagwali, Gloria (Ed.): *Science and technology in African history with case studies from Nigeria, Sierra Leone, Zimbabwe, and Zambia*, Edwin Mellen Press, Lewiston NY (USA), 204 p.

In science, the areas of focus include mathematics, medicine, and the sociology of medicine, as well as biologically-based warfare. In technology, iron, gold, diamond, and glass-making technologies dominate. Three of the cases of metallurgical development are centered on the pre-colonial periods. The book includes KANI-92b.

THOM-93

Includes chapters on methodological issues, textile technologies, traditional medicine, food processing, metal technology, mechanics and engineering.

TOB-90

TOO-90

Contains the critical edition and the English translation of Books V, VI, and VII of the Conics of Apollonius, on the basis of the Arabic version translated from the Greek by Thâbit Ibn Qurra (d. 901) and corrected by the brothers Banû Mûsâ (9th century).

TOR-63
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TOUH-79
1979 Touhoun, Benjamin: La numération décimale: le cas Aja [Decimal numeration: the case of Aja], Actes du Séminaire National de Formation Linguistique, CNL, Lokossa (Benin), 164-178.

TOU-94

Contains the proceedings of a seminar held at Yamoussoukro, January 25 to 29, 1993. The following sections deal with culture and mathematics:

* Tony Lévy: Euclid’s Elements, text and history (10-13);
* Salimata Doumbia: Verbal games and traditional mathematics education in Africa (92-96);
* Salimata Doumbia: Cowrie games (97-101);
* Paulus Gerdes: Ethnomathematics as a new research area in Africa (101-106).

TOU-00

TOU-01

TOU-02
“Mathematics teaching in the French-speaking countries of Africa and the Indian Ocean. We examine Mathematics teaching in the French-speaking countries of Africa and the Indian Ocean, starting from the consequences of the Colonial Period. At that time, education was mainly aimed at preparing the civil servants., and there was no organized structure for teaching. When they became independent, these countries started with the French system and methods, but they progressively realized that it was not totally adapted to the aims and specificities of such countries. So progressively new systems and curricula were designed. In this paper, we describe some examples, and give some trends in the development of Mathematics education in Africa and Indian Ocean, and perspectives for the future.”

TOUS-93

TRA-06
2006 Traoré, Kalifa: *Étude des pratiques mathématiques développées en contexte par les Siamous au Burkina Faso* [Study of mathematical practices developed-in-context by the Siamous of Burkina Faso], doctoral thesis, Université de Quebec à Montréal (Canada) (in French).

TRE-50

TRO-80

Analyses the following numeration systems: Akan (Anyi, Baoule, Aboure, Attie, Ebric, Aladian), Bete, Dida, Dan, Gouro, Kroumen, Koulango, Djan (Lobi), Malinke (Dioula), Senoufo, Tagwana, Wes. Discusses the characteristics of these numeration systems (base
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twenty, base ten, mixed twenty-ten, base five) and proposes a numerical map of the country dividing it in four regions according to the characteristics of the systems.

TUC-95

This is a phonographic script for writing the Mende language and a number writing system used to write Mende number words: “Like the dyllabic characters of the writing system, the numerals of the decimal based number writing system are written from right to left, from greater units to lesser units. Any number, other than zero, can be written in the system. Interestingly, while the numerals are decimal based, Mende number words are conceptualized largely on a vigesimal system of counting. The two systems overlap: numerals are written decimally and read aloud vigesimally” (African Languages and Cultures, Vol. 8, No. 2, 1995, p. 172).

TUC-99

The paper presents new information on the Bagam script, an autochthonous writing system from Cameroon, which has now fallen into extinction. On page 73 are illustrated the numerals for one to ten. On page 77 the author notes the possible connection of the Bagan numerals to the Bamum numerals.
Bibliography: U

UAI-92

Analyses symmetries of plaited ornaments in *khwama* baskets among the Changana in the South of Mozambique.

UKA-97

UKP-84

UNE-74

Includes a survey of research in Africa involving conservation and classification together with a not annotated bibliography (84-92) on the development of science and mathematics concepts in African children.

UNE-75

Final report of the symposium ‘Interactions between linguistics and mathematical education’ held in Nairobi (Kenya, 1-11 September
Mathematics in African History and Cultures

1974). Analyses the relation between the learning of mathematics and the language through which it is learnt. The report analyses the situation in several countries of Anglophone Africa. Cf. CHI-74, COLL-74, MMA-74, YOH-74.

Includes the following papers:

* R. Morris: Linguistic problems encountered by contemporary curriculum development projects in mathematics (25-58)
* P. Strevens: Mutual concerns between teachers of mathematics and areas of linguistics (59-63)
* M. Halliday: Some aspects of sociolinguistics (64-73)
* R. Clark: Some aspects of psycholinguistics (74-81)
* J. Gay: Pedagogical implications (82-84).
VAH-94

VAQ-99

VEL-82

VEL-84

Describes the use of the traditional ‘bamane’ counting system by illiterate Bambara (Mali). It is a mixed counting system with bases 10, 80 and 800.

VEL-88

Analyses the cognitive processes used by the Bambara population of Mali when solving problems of mental calculation.
VEL-93

VELP-04
2004 Velpry, Christiaan: Euclide l'Africain ou la géométrie restituée – enquête mathématique et historique [Euclid the African or geometry restored – a mathematical and historical enquiry], Éditions, Menaibuc, Paris (France), 113 p. (in French).

Contains a collection of reflections on the “themes of geometry and logic, Euclid’s postulate, history of geometry and philosophy from Alexandria to our days.”

VER-81

VER-86

This paper gives an application of factor analysis to the study of the symbolical expression of numbers in the Cokwe drawing tradition (Angola).

VER-99
1999 Vergani, Teresa: Ethnomathematics and symbolic thought. The culture of the Dogon, ZDM, International Reviews on Mathematical Education, Karlsruhe (Germany), No. 2, 66-70.

The paper deals with “the following aspects of the culture of the Dogon (Mali): the specific mythological context and the related cognitive system; fundamental poles in the Dogon numerical symbology; the density of 5’s significance; the spiral as a choreography of thought; ethnomathematics ‘logosymbols’ as ‘event’
and social meaning; educational implications (transcultural expression of thought and feeling).”

VERH-92

VERN-51

Partial critical edition in Arabic, Spanish translation and commentaries of “The student guide for the correction of the movements of the stars” of Ibn al-Bannà.

VERN-58

VERR-00

VERR-01

The author, who taught at Obafemi Awolowo University in Ile-Ife (Nigeria) between 1979 and 1986, reflects on how science, mathematics, and logic come to life in Yoruba primary schools. She describes how she “went from the radical conclusion that logic and math are culturally relative… to a new understanding of all generalizing logic.”

Review: ASC-03.
VIS-85a

VIS-85b

VITH-93

VIT-93


VIT-95a

VIT-95b

1996 Vitrac, Bernard: La Définition V. 8 des Eléments d’Euclide [Definition V.8 of Euclid’s Elements], Centaurus, Copenhagen (Denmark), Vol. XXXVIII, No. 2-3, 97-121 (in French).


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VIT-02

VIT-04a

VIT-04b

Contains the following papers: Invention of geometry: an enigma (30-37); A first scandal in geometry? (38-45); The Alexandrian mathematical tradition (46-51); Euclid, the founder (52-59); Measure and prove (60-65); Construct and compare (66-71); Archimedes (72-81); The Roman conic and the contribution of Apollonius (82-89); The renewal of Alexandria (90-95); The end of the Alexandrian world (96-99).

VOG-30

VOG-59
1959 Vogel, Kurt: *Vorgriechische Mathematik* [Pre-Greek Mathematics], Vol. 1: *Vorgeschichte und Ägypten* [Prehistory and Egypt], H. Schroedel Verlag, Hannover (Germany) (in German).

VOG-70
1970 Vogel, Kurt: *Die Grundlagen der Ägyptischen Arithmetik, in ihrem Zusammenhang mit der 2/n tabelle des Papyrus Rhind*
Bibliography

[Foundations of Egyptian arithmetic in its relationship with the 2:n table of the Rhind Papyrus], M. Söndig, Wiesbaden (Germany), 211 p. (in German).

Originally a doctoral dissertation from 1929 (Beckstein, Munich, Germany).

VOGE-99

VOGEL-92

VOL-94

Analyses the South African mathematics education context.

VOR-83

Comparative study of numeration in the Balesi-Obi (decimal) and Mamwu languages spoken in Northeastern Congo (Zaire), based on data collected in the period 1954-1960. In the Mamwu language exist basic number words for 1, 2, 3, 4, 5, and 10, and by using also the terms elí (hand), qarú (foot) and múdo (human, 20), the cardinals are formed.
WAE-37
1937 Waerden, Bartel L. van der: Arithmetik und Rechentechnik der Ägypter [Arithmetic and technique of computation of the Egyptians], Berichte der Sächischen Akademie, Leipzig (Germany), Vol. 89, 171-172 (in German).

WAE-38

WAE-54

The following sections deal with directly with mathematics in Egypt: The Egyptians (15-36), The Alexandrian Era (330-200 BC) (201-263), The decay of Greek mathematics (264-291).

WAE-74

WAE-80
1980 Waerden, Bartel L. van der: The (2:n) Table in the Rhind Papyrus, Centaurus, Copenhagen (Denmark), Vol. 24, 259-274.

WAE-83

Several sections of the book deal with mathematics in Egypt: The Moscow papyrus (44), Diophantus and his predecessors (97-112), Egyptian problems (160-161), Mathematical papyri from Hellenistic
Egypt (164-170), An Ancient Egyptian rule for squaring the circle (170-172), Heron of Alexandria (181-188).

WAGN-83

WAL-65

Analyses mal-communication of measurement (area, length) in Lesotho, involving Sesotho and English.

WAS-88

Shows how patterns from cultures from all over the world, can be classified according to the symmetries, which generate them. It examines a number of patterns from African contexts.

WAS-90

“The study shows that while two kinds of features are used for category definition (object-specific features and basic perceptual properties) the style of a culture is primarily defined by the way the basic properties are specifically manipulated. This thesis is illustrated by a study of named pattern categories on Bakuba raffia cloth. One of the basic perceptual properties is symmetry. Chapter 5 details how a symmetry analysis of the raffia patterns can differentiate patterns produced by the different Bakuba groups.”
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WATE-93

WAT-86

WAT-87

WAW-91

WEB-67

Among the problems discussed are those of the pupil’s background and the effect on pupils of the change of teaching method, both related to the culture and tradition of Tanzania.

WEI-78

WEU-21
1921 Weule, Karl: Die Anfänge der Naturbeherschung, Vol.1: Frühformen der Mechanik [The beginnings of the control of
Studies early forms of knowledge of mechanics as embodied for instance in the making traps. Includes, in particular, examples from East Africa.

WHI-88

Suggests the use of graphs drawn traditionally in the sand by children of the Shongo – one of the [Ba]Kuba groups of Congo / Zaire – in the mathematics classroom.

WHIT-01

Shows, among other examples, how *kenta* cloth from West Africa may be explored in a geometry lesson.

WILD-75

WIL-78

WILA-71
WILA-74

WILA-76

The papers WILA-71, WILA-74, and WILA-76 deal with the African Mathematics Program.

WILA-93

WILL-43

“While searching for Dabida ways of using arithmetic, for the purpose of making the early studies of young children easier and more interesting, it was discovered that several sets of ‘numerals’ exist.” These sets are described. “A counting system reputed to be much older than those in use today is still used by children in their early arithmetic work; they can sometimes be heard repeating these numbers with the aid of their fingers.” The Dabida inhabit the Taita hills in Kenya.

WILLI-70

“Among the Kolokuma Ijo of the Niger Delta odd numbers in general, and three in particular, are associated with men; while even numbers in general, and four in particular, are associated with women. The number seven is associated with the great divinities of the clan, such as Kolokuma Egbesu, and is therefore normally avoided.” The paper gives examples.
WILS-80

“This survey covers the period 1962-1978. It shows how the historical processes of decolonization and the emergence of a Commonwealth of sovereign nations has led to a remarkable uniformity of mathematics curricula in secondary schools in the Anglophone countries of east, West and Central Africa. Three curriculum projects of major influence – ‘Entebbe’, SMP and JSP – are considered in more detail. The emergence of the African Mathematical Union is welcomed as an attempt, on a professional plane, to bridge the political gulf between Anglophone and Francophone African countries.”

WILS-81


WILSO-94

Short note on (a)symmetries in Kuba art.

WOL-54
YAD-71

YAD-78

YAS-73

YAS-80

YOH-74


YOU-76

A description of two Arabic texts with commentaries on Menelaus’ *Sphaerica*, one written by At-Tûsî (Persia) in the 13th century and the other by the 17th-century mathematician Al-Yazdî (Persia).
ZAS-70a

Overview of various number systems in Africa.

ZAS-70b

ZAS-73a


Review: WILD-75.
Translations: ZAS-84, ZAS-95.

ZAS-73b

Presents some examples for classroom use from the (Ba)Kuba culture (Congo / Zaire) and from cowrie shells currency in West Africa.

ZAS-75
ZAS-76a

ZAS-76b

ZAS-76c

ZAS-79

Examples of bilateral and rotational symmetries, repeated patterns on a strip, tessellations in the plane, occurring in African art, architecture and design (e.g. *adinkra* cloth of the Asante people, Ghana; *adire* cloth of the Yoruba people, Nigeria) are given and it is shown how these examples may be integrated in an interdisciplinary approach to the study of mathematics.

ZAS-80

The book “guides children (ages 6-9) through the animated activity of the marketplace, showing the traditional finger counting of various African peoples – the Maasai, the Kamba, and the Taita in Kenya; the Zulu of South Africa; and the Mende of Sierra Leone.”

ZAS-81

Graph theoretical analysis for school children of the networks drawn by the Kuba of Congo.
ZAS-82

“Games suitable for all ages, reading level ages 9-12.” Includes several African versions: Achi (Ghana), Shisiba (Kenya), Murabaraba (Lesotho), Dara (Mali, Morocco, Niger, Nigeria), Akidada (Nigeria), Tsoro Yematatu (Zimbabwe).

ZAS-84

Hungarian translation of ZAS-73a.

ZAS-89a

Gives information on the tradition of round houses in Africa and other parts of the world with suggestions for incorporating this issue in the mathematics classroom.

ZAS-89b

ZAS-93

Activities for middle grade students, involving ancient Egyptian numeration and computation, cowrie shell and other currency in West Africa, the African slave Thomas Fuller, Egyptian pyramids, probability with cowry shells and the Nigerian game of Igba Ita, and Chokwe and Kuba networks.
ZAS-94a  

A description of the motivation for and some of the research leading to the author’s classic ZAS-73a.

ZAS-94b  


ZAS-95  


ZAS-96  

Pleads for a multicultural mathematics curriculum and presents examples of mathematical activities for use in the classroom, including many examples from Africa.

ZAS-98  

Book for children for ages 9 and up. Includes several examples of mathematical games or activities from Africa, like: [three-in-a-row games] *Shisima* from Kenya (4-5), *Tsoro yematatu* from Zimbabwe (8-9), *Dara* from Nigeria (18-19); [Mankala board games] Easy *oware* from Ghana (22-23), The real *oware* game from Ghana (24-25), *Giuthi* from Kenya (28-29); [More board games] *Yoté* from West Africa (42-43); [Games of chance] *Igba-ita* from Nigeria (52-53); [Puzzles with numbers] Magic squares from West Africa (64-65), Dividing the camels from North Africa (73-74), The Ishango bone from Congo
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(75); [Puzzles without numbers] Crossing the river in Liberia (81), Crossing the river with jealous husbands from Kenya (82), The snake and the swallow’s nest from Angola (84), The Chokwe story tellers from Angola (85-86), Decorations on the walls from Angola (87), How the world began from Angola (88-89), Children’s networks from Congo (90-91); [Geometry all around us] Round houses in Kenya (100), Cone-cylinder houses in Kenya (101-102), The pyramids of ancient Egypt (105-106); [Repeating patterns] African patterns from Congo (127-129), Adinkra cloth from Ghana (133-134).

Translations: ZAS-00b, ZAS-02.

ZAS-99a

Reprint of Claudia Zaslavsky’s classical study ZAS-73a, updated with an additional chapter on ethnomathematics in Africa.

ZAS-99b

New edition of ZAS-80.

ZAS-00a

The appeal of such activities to African-American students at various grade levels, based on actual classroom experiences.

ZAS-00b

Translation into Portuguese of ZAS-98 by Pedro Theobald.

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ZAS-00c

ZAS-02

Chinese language edition of ZAS-98.

ZAS-03a

Sequel to ZAS-98. For children age nine and up. Includes the following games and activities from Africa: [Three-in-a-Row Games] *Achi* from Ghana (14-15), *Murabaraba* from South Africa and Lesotho (23-25); *Alquerque de Nueve* from Muslim Spain and North Africa and *Akidada* from Nigeria (18-20); [More Board Games: Mankala] Little Goat Game and Cow Game from Sudan (35-38), *Adi* from Ghana (39-41); [How People Use Numbers: Money] Beads, Shells and Gold from Africa (56-57); [Is There a Lucky Number?] Magic Squares from the Muslim World (70-71); [How People Measure] Standard Measures from Ancient Egypt (81); [Puzzles with Dots, String, and Paper Strips] *Julirde* from West Africa (91-93), Bead and String Puzzle from West Africa (94-95), Animal Picture and “Three Villages” Sand Drawings from Angola (98-103); [Symmetry and Similarity of Designs] *Akua Ba* Doll from Ghana (114-115); [Repeated Patterns] *Adire* Cloth from Nigeria (138-139).

ZAS-03b

“The article traces the development of the alphabetic numeration systems of the early Greeks, Hebrews, and Arabs to the concepts underlying ancient Egyptian hieratic numeration, and includes activities for students.”


Based on the responses of secondary school students in a rural context - North Shoa, Ethiopia - the author investigates gender differences in mathematics achievement and attitudes. “...a significant gender difference was found in mathematics achievement, but not in attitude.”


Examines “gender differences in mathematics achievement among fifth and sixth grade students in Addis Ababa (Ethiopia) and identifies factors that account for variations in their performance.”


ZEP-83c  1983  Zepp, Raymond: *L'apprentissage du calcul dans les langues de Côte d'Ivoire* [The learning of arithmetic in the languages of Ivory Coast], Institut de Linguistique Appliquée, Université d'Abidjan, Abidjan (Côte d'Ivoire), Vol. 99, 121 p.


Presents an introduction to Egyptian unit fractions and their influence on other subjects.


Contains two modules on Africa: Number systems from Africa (1-8) and Unit fractions (37-44).

ZYL-42  1942  Zyl, Abraham Johannes van: *Mathematics at the cross-roads: a critical survey of the teaching of mathematics in the secondary schools of the Union of South Africa with suggestions for*
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ZYL-43
1943 ZYL, Abraham Johannes Van (South Africa): Mathematics at the cross-roads, Maskew Miller, Cape Town (South Africa), 239 p.

Example of a woven strip design from Zanzibar (Tanzania) (cf. GER-99a, p. 145)
APPENDICES

Appendix 1
On mathematicians of African descent / Diaspora

See also: EGL-95c, EGL-97b, LUM-87, LUM-92b, LUM-95b, LUM-95c, LUM-96.

1-AGW-03

1-BAL-56

Contains (p. 470) brief information on Thomas Fuller (1710-1790), born in Africa and brought as a slave to Virginia (USA) in 1724. Fuller was a prodigy in mental arithmetic. E.g. he could multiply nine-digit numbers.

1-BED-72

“Benjamin Banneker (1731-1806) was a famous member of the community of ‘mathematical practitioners’ in Colonial America. A landed freeman and tobacco planter, Banneker was introduced to astronomy and surveying during the 1780s, learning from the popular Newtonian texts of the period with the help of his neighbor George Ellicott. Banneker mastered methods for the calculation of ephemerides and incorporated his results in a series of almanacs published in Philadelphia, Baltimore, and other eastern cities between 1791 and 1796. During 1791 he served as astronomical assistant on the survey of the District of Columbia directed by Andrew Ellicott. Using all extant records concerning Banneker’s life and a wide variety of other sources, Bedini has reconstructed the intellectual and social environment in which Banneker worked” [abstract published in:
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1-CAMA-04

Short article based on 1-FAU-90a.

1-DEAN-98

This book is the report of a Discrete Mathematics and Theoretical Computer Science (DIMACS) workshop (June 26-28, 1996). It includes the invited research talks by Jonathan D. Farley, Carolyn R. Mahoney, Curtis Clark, Walter M. Miller, Nathaniel Whitaker, Isom H. Hernon, Floyd L. Williams, and Scott W. Williams (cf. AMUCHMA 20:6.2), poster presentations, and the following historical articles:

* Lorch, Lee: Yesterday, today and tomorrow (157-168);
* Falconer, Etta: The challenge of diversity (169-182);
* Kenschaft, Patricia: What next? A meta-history of black mathematicians (183-186);
* Hill, Donald: A personal history of the origins of the National Association of Mathematicians’ “Presentations by recipients of recent Ph.D.’s” (187-193);
* Agwu, Nkechi & Asamgah Nkwanta: Dr. J. Ernest Wilkins, Jr.: The man and his works (195-205).

1-DON-00

A biography of Elbert F. Cox, the first African-American to earn a Ph.D. in mathematics.

1-EGL-01
“Focusing on the black Diaspora, this essay broadens the category of ‘information technology’ to show how traditions of coding and computation from indigenous African practices and black appropriations of Euro-American technologies have supported, resisted, and fused with the cybernetic histories of the west, and provide a strong source for changes in reconstructing identity, social position and access to power in communities of the black Diaspora.”

1-FAU-90a

Thomas Fuller (1710-1790) was an African, shipped to America as a slave in 1724. He had remarkable powers of calculation, and late in his life was discovered by antislavery campaigners who used him as a demonstration that blacks are not mentally inferior to whites. This paper describes what we know of Fuller, discusses the various uses made of his story since his death, and appeals for further study of the 18th-century African ethnomathematical context.


1-FAU-90b

Translation of 1-FAU-90a.

1-FAU-92

Translation of FAU-90a.
1-HAL-87

1-HAW-99

Poster with drawings of the first Ishango rod, photographs of the Ahmose’ Papyrus (‘Rhind’ papyrus), and short biographies of Benjamin Banneker (1731-1806), Elbert Frank Cox (1895-1969), Evelyn Boyd Granville (b. 1924), Majorie Lee Browne (1914-1979), J. Ernest Wilkins, Jr. (b. 1923) and David H. Blackwell (b. 1919). The backside of the poster contains also a list of the earliest African-Americans with a doctorate in mathematics.

1-HER-29

1-HER-32

1-JOH-84

1-KEN-81
Appendix 1

1-KEN-87

The article is the result of numerous interviews with and letters from “leading black men and women in mathematics and their friends.” It includes short biographies on the African-Americans who received a doctorate in mathematics.

1-KRAP-98

1-NEW-80

The first part of the book consists of scholarly articles published by North-American mathematicians of African descent. The second part is a biographical index of all mathematicians surveyed. Appendices are included, among them articles and letters concerning discrimination against blacks in the field of mathematics.


1-REDD-06

1-SPA-03

1-WILLIAM-99
1-WILLIAM-03
2003 Williams, Scott: Mathematicians of the African Diaspora [available online at: www.math.buffalo.edu/mad/]

1-ZAS-83
Appendix 2
Publications by African scholars on the History of Mathematics outside Africa
(including reviews of these publications)

2-BOUD-98

2-DJE-93

This paper contains the not previously published results of research conducted between 1982 and 1984, on the life and activities of two important mathematicians of Islamic Spain who were interested in Geometry and Number Theory.

2-DJE-98

2-DJE-99a

Presents the essential aspects of the contribution of the great philosopher and physician Avicenna (d. 1037) to the domains of mathematics and astronomy.

313
“This paper studies the first chapter of Kitab al-Istikmal, a work of the 11th century by al-Mu’tanan Ibn Hud, a mathematician from al-Andalus who was the king of Zaragoza between 1081 and 1085. Different chapters of this remarkable work in the Arabic mathematical tradition have already been studied in the last decade, while others are still in progress.”

Paper dedicated to the life and work of Omar Khayam (d. 1131), in relationship with the scientific and cultural activities of his time.

The paper is addressed to high school and college students. It presents, in an anecdotal form, some information about the birth of algebra and its development since the first Babylonian practices until the arrival of algebra in Europe from the 12th century onwards.

The paper is addressed to young pupils and presents the life and works of the poet and mathematician Omar al-Khayyam (d. 1139).
2-DJE-02

Tells the story of the extraordinary fate of an important work by the mathematician and king of Zaragossa, al-Mu’taman (d. 1085), of its transmission from Europe to Asia passing through North Africa, and of its discovery — less than 20 years ago — by two researchers, Jan Hogendijk (Netherlands) and Ahmed Djebbar (Algeria).

2-DJE-05
2005 Djebbar, Ahmed: Kamâl Eddîn Fârsî, Physicien et mathématicien novateur [Kamâl Eddîn Fârsî, innovating physicist and mathematician], Târikh-e’Elm, Teheran (Iran), No. 3, 9-38 (in French).

2-GER-03

The paper discusses some geometrical aspects of Bora basketry in the Peruvian Amazon. In particular, twill-plaited, circular trays called ‘níjtyubane’ are analysed. Elements of their production and of the creation and transformation of geometric patterns are studied. An outline of their historical development is presented that stresses the similarity and the cultural diversity.

2-HIT-96
Dramatic presentation of De Morgan’s reminiscences at the end of his life, reflecting about the development of logic and algebra.

2-HIT-97

Six snapshots of important representative moments in the teaching of the negatives are represented in historical sequence as classroom scenes.

2-HOG-00

2-JAO-76

2-OGU-88

Examines a “few of the historical events and characters that contributed some works or discoveries in function-related concepts.”

2-RAS-99

Critical editions in French of al-Khayyam’s works *The Algebra*, an untitled treatise written before the *Algebra*, and a commentary on the difficulties in the postulates of Euclid’s *Elements*.

Review: 2-HOG-00.
Appendix 3
On Time-reckoning and Astronomy in African History and Cultures

See also BARR-93a, 94a, 96a, 97a, 97b, 99; BRU-65; BRUM-93a, 93b, 94; HARA-00; LOR-95; OBE-73, 90; SEL-97; UKA-97; VERN-52, 56.

3-ADA-83a

3-ADA-83b

3-ANDE-87
1987 Andersen, K.: The central projection in one of Ptolemy’s map constructions, Centaurus, Copenhagen (Denmark), Vol. 30, No. 2, 106-113.

3-BAS-88

3-BEI-63

3-BERG-91

3-BERG-92
1992 Berggren, J. Lennart: & Thomas, R. S. D.: Mathematical astronomy in the fourth century BC as found in Euclid’s
Mathematics in African History and Cultures


3-BERG-96

3-BRIT-69

3-BRIT-92

3-BRUE-32

3-BRU-65

3-BRUM-94

3-CAR-84
3-CHAB-93

3-CHAT-49

3-COO-94

3-COO-96

3-DAL-94

3-DALL-95

3-DELS-96

3-DEY-00
“Ancient Egypt had a wide-ranging but essentially qualitative understanding of the heavens. The regularity of the annual inundations removed the necessity to make extensive predictions of future meteorological or climatological events. Despite making extensive observations, the reliance on extremely simple observational devices effectively prevented the growth of any complex theories or predictive algorithms. The primary concern seems to have been connected with time measurement, both for agricultural and religious purposes, as well as articulating analogies that were taken to point toward the possibility of a future life through constant rebirth, like the celestial lights” (p. 507).

3-DOB-90

3-DOY-86a

3-DOY-86b

3-DRAK-78

3-DUN-26

Describes pre-colonial time-reckoning among the Wachagga (Kilamanjaro-region, East Africa): the year is divided into twelve months; each month has thirty days and is divided into six periods of five days each. Describes also the belief in the influence of the day and the hour in which a person is born, on his character and life.
3-EVA-39

3-EVAN-84
1984 Evans, J.: On the function and the probable origin of Ptolemy’s equant, American Journal of Physics, Amherst MA (USA), Vol. 52, No. 12, 1080-1089.

3-FOM-89

3-GING-84

3-GING-93
1993 Gingerich, Owen: The Eye of Heaven: Ptolemy, Copernicus, Kepler, American Institute of Physics, New York (USA), 442 p.

3-GING-01

3-GOL-97

3-GOLD-82
Mathematics in African History and Cultures

3-GRAS-00

3-GRIA-49

3-GRIA-50

3-GRIA-51

3-HAM-87

3-HARTN-74

3-HARTN-80

3-HIS-67
Appendix 3

3-IBI-99

Proceedings of a 1997 conference, containing among others the following papers:

* Julio Samsó: Andalusi and Maghribi Astronomical Sources: What has been done and what remains to be done (75-104);
* Hossein Massoumi Hamedani: Remarks on the manuscript tradition of some optical works of Ibn al-Haytham (165-180).

3-JON-90

3-JON-99

Translation of and commentary on astronomical papyri found in an early 20th century dig at the Roman provincial capital of Oxyrhynchus, Egypt. Offers a glimpse of the state of astronomy around the time of Ptolemy.

3-JUN-74

3-KELL-02

3-KENN-89
“This article first examines week calendar names in a few East African languages, namely Amharic, Luo, Kihacha, Kinyakyusa, Kihaya and Kingwana. Then it turns to the Kiswahili calendar. This calendar has Friday as its fixed day of prayer/rest and the day after which the counting of the week calendar starts. The name for Friday, ‘Ijumaa’ (from the Arabic ‘Aj-Jumaa’, ‘the day of congregation’), as well as the name of the day preceding it, ‘Alhamisi’ (from the Arabic ‘Al-Khamiis’, the 5th day), are borrowed from the Arabic/Islamic calendar. The Kiswahili calendar also deploys the numerical system in labeling all days of the week except Friday. This has led to this calendar containing two ‘fifth’ days.”

3-KUN-93

3-KUN-94

3-LAC-72

3-LANGE-82
Appendix 3

3-LEB-98

Presents evidence of the use of astronomical phenomena to make weather predictions in Egypt in the 4th century BC.

3-LEGE-73

3-LYN-78

3-LYN-83

“Namoratunga, a megalithic site in northwestern Kenya, has an alignment of 19 basalt pillars that are non-randomly oriented toward certain stars and constellations. The same stars and constellations are by modern Cushitic peoples to calculate an accurate calendar. The fact that Namoratunga dates to about 300 BC suggests that a prehistoric calendar based on detailed astronomical knowledge was in use in eastern Africa.”

3-MAC-98

3-MAEY-84
The K’ottu (the Muslim Oromo of Hararghe, Ethiopia) have a solar and lunar time-reckoning based on the alternation of the seasons, agricultural operations and religious regulations.
3-MORE-81

3-MURS-95

3-NEU-60

3-NEU-79
1979 Neugebauer, Otto: Ethiopian Astronomy and Computus, Austrian Academy of Science, Vienna (Austria), 263 p.

3-NEU-81
1981 Neugebauer, Otto: The ‘astronomical’ chapters of the Ethiopian Book of Enoch (72 to 82), Det Kongelige Danske Videnskabernes Selskab, Copenhagen (Denmark), 42 p.
Translation and commentary by Otto Neugebauer with additional notes on the Aramaic fragments by Matthew Black.

3-NEU-88

3-NEU-89
1989 Neugebauer, Otto: Chronography in Ethiopian sources, Academy of Science, Vienna (Austria), 151 p.
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1964 Niangoran-Bouah, Georges: *La division du temps et le calendrier rituel des peuples lagunaires de Côte d’Ivoire* [The division of time and the ritual calendar of the lagoon peoples of Côte d’Ivoire / Ivory Coast], Institut d’Ethnologie, Musée de l’Homme, Paris (France), 164 p. (in French).


1987 Obenga, Théophile: Notes sur les connaissances astronomiques bantu [Notes on Bantu astronomic knowledge], *MUNTU, revue scientifique et culturelle du CICIBA*, Libreville (Gabon), Vol. 6, 63-78 (in French).

Reviews the literature on astronomical knowledge in ancient Egypt, among the Borana (Ethiopia), Dogon, Lobi, Bambara (West Africa), Vili (Congo), Fang (Cameroon, Equitorial Guinea, Gabon), and Mbochi (Congo).


Appendix 3

3-PETERS-74

3-PETERSE-67

3-PETERSE-69

3-PING-82

3-PING-97

3-RAW-87

3-ROBE-81

3-ROM-43
3-ROM-52

3-RUG-87

3-SAB-71

3-SAB-77

3-SAB-78

3-SAB-79

3-SAB-82


Haytham (who lived in Egypt until 1039) with the version of the group of scientists organized by Alfonso X of Castilla (13th century).

3-SEZ-86

3-SEZ-97a

The first volume on Ibn Yunis Abu l-Hassan’s astronomic work contains papers by Richard Dunthorne (1-10); George Costard (11-23); Jean Bernouilli (25-53, in French); and Armand-Pierre Caussin de Perceval (54-278, in Arabic and French).

3-SEZ-97b

The second volume on Ibn Yunis Abu l-Hassan’s astronomic work contains papers by Jean-Baptiste Joseph Delambre (1-96, in French); Louis-Amélie Sédillot (97-101, in French); Armin Wittstein (102-104, in German); Carl Schoy (105-315, in German); and J. H. Reynolds (316-317).

3-SEZ-98a


3-SEZ-98b

The volume on the astromic work of Abu ‘Ali al-Hassan (Morocco) contains papers by Dominique François Jean Arrago & Charles Mathieu (1-3, in French); Jean-Baptiste Biot (5-43, in French); Louis-Amélie Sédillot (45-312, in French); Edward J. Stone (314-316); Carl Schoy (317-350, in German); August Wedemeyer (352-364, in German).

3-SHEV-90

3-SNE-96

3-SNE-97

3-SNE-98
The paper presents an overview of pre-colonial astronomical practices. The paper is structured in the following sections: sources of evidence, astronomical practices in the built environment, Khoisan sky lore, time reckoning in agricultural communities, cosmology and social cohesion, astronomical practice as an indicator of cultural exchange, colonialism and the decline of African astronomical practices.

**3-SOP-82**

**3-SWE-89**

**3-SWE-92**

**3-TAB-94**

**3-TAIS-84**

**3-THOR-80**
Appendix 3

3-TAB-88

Analyses time reckoning among the Gabra and compares it with the calculation of time among the Borana.

3-TAB-94

Analyses time reckoning among the Borana (northern Kenya).

3-TIH-76

3-TIH-85

3-TIH-87

3-TOO-84

3-TOO-98
“Ptolemy's *Almagest* is one of the most influential scientific works in history. A masterpiece of technical exposition, it was the basic textbook of astronomy for more than a thousand years, and still is the main source for our knowledge of ancient astronomy. This translation, based on the standard Greek text of Heiberg, makes the work accessible to English readers in an intelligible and reliable form. It contains numerous corrections derived from medieval Arabic translations and extensive footnotes that take account of the great progress in understanding the work made in this century, due to the discovery of Babylonian records and other researches. It is designed to stand by itself as an interpretation of the original, but it will also be useful as an aid to reading the Greek text.”

3-TUR-78

3-VERG-37

3-VERN-98
1998 Vernet Ginés, Juan: *Contribución al estudio de la labor astronómica de Ibn al-Bannâ* [Contribution to the study of the astronomic work of Ibn al-Bannâ], Institute for the History of Arabic-Islamic Science, Johann Wolfgang Goethe University, Frankfurt am Main (Germany), Collection “Islamic mathematics and science”, Volume 43, 220 p. (in Arabic and Spanish)


3-WAE-57

3-WAE-58
Appendix 3

3-WAE-71

3-WAR-96

3-WILSON-84

3-WLO-90

3-ZAH-51

Analyses the notion of eclipse among the Dogon and the Bambara (Mali).
Appendix 4
String Figures in Africa

See also GER-95b, 96b, 98d; GIB-96; MOS-96, 97, 98a, 98b, 00a, 03.

4-CAN-93

4-CUN-06

4-CUN-96
1996 Cunnington, William: The Moon Gone Dark, collected by W. Cunnington from the Marungu people of Congo / Zaire, *String Figure Magazine*, Pasadena CA (USA), Vol. 1, No. 4, 5-7.

4-CUN-99
1999 Cunnington, William: A bed, collected by William Cunnington at the south end of Lake Tanganyika, *String Figure Magazine*, Pasadena CA (USA), Vol. 4, No. 3, 16-18.

Partial reproduction of 4-CUN-06.

4-EAR-98
1998 Earthy, E. D.: Border between two countries, collected by E. D. Earthy from the Thonga people of Mozambique, Africa, *String Figure Magazine*, Pasadena CA (USA), Vol. 3, No. 4 11-14.


4-EVA-55

4-GRIA-38
1938 Griaule, Marcel: Jeux de ficelles [String figures], in: M. Griaule, *Jeux Dogon* [Games of the Dogon], Institut d’Ethnologie, Paris (France), 71-83.
Collection of string figures from the Dogon (Mali).

4-GRIA-97
1997 Griaule, Marcel: Nose Slip Trick, collected by M. Griaule from the Dogon people of Mali, *String Figure Magazine*, Pasadena CA (USA), Vol. 2, No. 1, 5-6.

4-GRIF-25

Collection of string figures from Ghana.

4-HAD-06

4-HADD-36

4-HADD-50

4-HOR-28

4-HOR-30

4-HOR-40

4-HOR-98
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4-LAG-50

Section on string figures (269-274) includes a map that illustrates the distribution of string figure making in Africa.

4-LEAK-49

Collection of 20 string figures collected among the Cokwe in January-February 1948. In a number of cases the Cokwe have “serial’ figures in which the successive stages seem to represent the illustrations of a story.” As far as the authors know “such ‘serial’ figures are relatively scarce in Africa.”

4-LIN-30
1930 Lindblom, Gerhard: String figures in Africa, Riksmuseets Etnografiska Avdelning, Smärre Meddelanden, Stockholm (Sweden), No. 9, 12 p.

4-PARK-06

4-REI-02
2002 Reichert, A.: Some string figures from modern Africa, Bulletin of the International String Figure Association, Pasadena CA (USA), Vol. 9, 241-248.

4-SMITH-99
1999 Smith, Carey C. K.: String Figures from the Congo, Bulletin of the International String Figure Association, Pasadena CA (USA), Vol. 4, 135-184.

“The article presents sixty-seven string figures gathered at Upoto in the former Belgian Congo by Mrs. Ethel M. Smith during the years 1910-1914. Among her informants were members of the Lingombe,
Lifoto, Ngombe, Ngwenzali, and Ngwengali tribes. Unlike F. Starr’s Congo collection published in 1909, the Smith collection includes methods of construction for each figure. In an appendix to this article, the author presents methods for making thirty-nine of the sixty-two figures described by Starr.”

4-SMI-00
2000 Smith, Carey C. K.: Some String Figures and Tricks from Sierra Leone and the Gold Coast, *Bulletin of the International String Figure Association*, Pasadena CA (USA), Vol. 7, 94-100 [Sierra Leone and Ghana].

4-SMITHE-98
1998 Smith, Ethel: ‘Mangbongobo’ or Flying Fox, collected by E. Smith from Congo / Zaire, *String Figure Magazine*, Pasadena CA (USA), Vol. 3, No. 1, 10-12.

4-STAR-09

4-STOR-03
2003 Storer, Tom: *String Figure Bibliography* (Available online at the website of the International String Figure Association (ISFA): www.isfa.org/biblio.htm)

General bibliography with a section on Africa that includes most references given in this appendix.

4-TES-12

4-TES-01
2001 Tessmann, G.; Reichert, A. & Sherman, Mark: Pangwe and Bubi String Figures, *Bulletin of the International String Figure Association*, Pasadena CA (USA), Vol. 8, 125-201.

Translation of 4-TES-12 with new illustrations and cultural notes.
4-TRA-36

4-TRA-99
1999  Tracey, Hugh: The eagle and its nest, collected by Hugh Tracey from the Mashona people of Southern Zimbabwe, *String Figure Magazine*, Pasadena CA (USA), Vol. 4, No. 1, 11-15

Partial reproduction of 4-TRA-36.

4-TRE-98

4-WED-30

Collection of string figures from Botswana.

4-WED-99
1999  Wedgwood, Camilla: Oxen inspanned, *String Figure Magazine*, Pasadena CA (USA), Vol. 4, No. 4, 20-24.

Reproduction of the making of a string figure by the Kxatla people of Botswana, originally included in the paper WED-30.

4-WIR-00

The web-page of the International String Figure Association (ISFA) is:
www.isfa.org
Appendix 5
Examples of Books and Booklets Published by African Mathematicians

5-AHM-02

5-ALVA-82

5-ALV-00

5-ANI-00

5-ASH-01

5-ASSA-03
5-BANY-97
1997 Banyaga, Augustin [Rwanda]: *The structure of classical diffeomorphism groups*, Kluwer, Boston (USA); Boston, 197 p.

5-BANY-99

5-BANY-02

5-BEI-82a

5-BEI-82b

5-BEI-83

5-BEI-92
5-BEI-93
1993 Beirão, João Carlos: *Funções de variável complexa* [Functions of complex variable], Textbook, Instituto Superior Pedagógico, Maputo (Mozambique), 175 p. (in Portuguese).

5-BEI-05
2005 Beirão, João Carlos & Cassy, Bhangy [Mozambique]: *Cálculo diferencial em R^n* [Differential calculus in R^n], Imprensa Universitária, Maputo (Mozambique), 226 p.

5-BELG-97

5-CAD-99

5-CHID-03

5-CHU-92

5-CHU-01
2001 Chukwu, Ethelbert Nwakuche: *Differential models and neutral systems for controlling the wealth of nations*, Series on
Mathematics in African History and Cultures


5-CHU-03

5-DZI-84

5-DZI-86

5-ELY-01a

AMUPAMO stands for African Mathematical Union Commission on Pan African Mathematics Olympiads. The proceedings include a report of the symposium and the papers presented in English or French at the plenary sessions:

* Aderemi Kuku: Mathematical sciences and other sciences (107-124);
* Jan Persens: Mathematics development – Striving for a balance between pure and applied mathematics, even at school level (125-136);
* Saliou Touré: Un exemple de coopération dans les pays francophones d’Afrique et de l’Océan Indien [An example of cooperation between the French-speaking countries of Africa and the Indian Ocean] (137-142) (in French);
* Claude Deschamps: Les Olympiades Internationales de Mathématiques [The International Mathematics Olympiads] (143-152) (in French);
Appendix 5

* Nouzha El Yacoubi: Olympiades Pan Africaines de Mathématiques de l’Union Mathématique Africaine [The Pan-African Mathematics Olympiads of the African Mathematical Union (155-168) (in French);

* Francisco Bellot Rosado: La compétition mathématique méditerranéenne [The Mediterranean mathematics competition] (169-171) (in French);

* Walter Mientka: The road to the International Mathematical Olympiad (173-177).

5-ELY-01b  

5-ELY-02  

5-ELY-03  
Proceedings of the 13th Pan African Mathematics Olympiad held in Maputo, Mozambique (April 19-27, 2003), organized by the African Mathematical Union Commission for the Pan-African Mathematical Olympiad (AMUPAMO) and hosted by the Ministry of education of Mozambique. Includes the paper “From African ‘sona’ drawings to
the discovery of new symmetries and matrices” (51-64) by Paulus Gerdes.

5-ESO-82

5-ESO-89

5-ESO-99

5-EZI-88

5-FATU-85

Proceedings of the first international conference on numerical analysis and its applications held in Benin City (Nigeria), November 2-4, 1983.

5-FATU-87


5-FATU-88

5-GAT-74

5-GER-90

5-GER-91

5-GER-92

5-GUID-85

5-HAS-86

5-HAS-91
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5-HAS-93

5-HOG-71

5-HOG-73
1973 Hogbe-Nlend, Henri: Distributions et bornologie [Distributions and bornology], Universidade de São Paulo, São Paulo (Brazil), 143 p. (in French).

5-HOG-77

5-HOG-81

5-HOUNK-00

Proceedings of the 1st International Workshop on Contemporary Problems in Mathematical Physics held in Cotonou (Benin), October 31 – November 5, 1999.

5-JEN-00
5-KUK-80

5-KUK-85


5-KUK-86
1986 Kuku, Aderemi O.: *Axiomatic Theory of Induced Representation of Finite Groups*, CIMPA, Nice (France).

5-KUK-94

5-KUK-97

5-KUK-99

Proceedings of a workshop and symposium held at the International Centre for Theoretical Physics (ICTP), Trieste, Italy.

5-KUK-06

5-KWI-04
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5-LAB-93
1993 Labuschagne, Willem [South Africa], *A user-friendly introduction to discrete mathematics for computer science*, University of South Africa, Pretoria (South Africa), 304 p.

5-MAK-00

5-MAS-97


5-MASE-74

5-MASE-88

5-MSH-90

5-MSH-92
Appendix 5

5-NGUER-01
2001  N’Guérékata, Gaston Mandata  [Central African Republic]:  

5-NGUER-04
2004  N’Guérékata, Gaston Mandata: Topics in almost automorphy, 
Springer, New York (USA).

5-NGU-90

5-NJO-99a
Lecture notes of a course on Galois Theory and its Applications given to students of the ‘Maitrise’ program at the Mathematics Department of the University of Yaoundé.

5-NJO-99b
Lecture notes of a course on Projective Geometry given at the University of Yaoundé, principally to students of the ‘Licence’ program for future mathematics teachers.

5-NKE-05
1997  Nkemzi, Boniface  [Cameroon]:  Numerische Analysis der Fourier-Finite-Elemente-Methode für die Gleichungen der Elastizitätstheorie [Numerical analysis of the Fourier finite elements method for equations from elasticity theory], Tectum Verlag, Marburg (Germany), 109 p.
5-OKI-71

5-OKI-80

5-OKI-81

5-OLAY-00

5-OLAY-01

5-OLAY-02

5-ROH-05

5-RUN-81
1981 Rund, Hanno [South Africa]: *Generalized connections and gauge fields on fibre bundles*, University of South Africa, Pretoria (South Africa), 120 p.

5-SAL-74
1974 Salbany, Sergio [South Africa]: *Bitopological spaces, compactifications and completions*, Math Monographs of the...
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University of Cape Town, Cape Town (South Africa), Volume 1.

5-SEY-72

5-SHO-00

5-TCHU-91

5-UKO-00

5-VITH-03

Study based on an analysis of the South African context. Published version of Vithal’s doctoral thesis (2000, Aalborg University, Denmark).

5-VITH-04
See also BEA-55; CEN-63; DOU; KLEP-72; KRA-83; MIZ-71; PAU-71; RAT-91; ZAS; 1-HER-29, 32.

6-ANN-38

6-AVED-71

Includes a reproduction of 6-CUL-94.

6-AVE-06

6-AVE-08

6-BALLO-78

6-BALLO-84

6-BEAT-39
Appendix 6


1986 Briere, B. & Briere, J.: *Awele*, Université de Paris VIII, Vincennes (France) (in French) [Ivory Coast].
“Certain endgame considerations in the two-player Nigerian Mancala-type game Ayo can be identified with the problem, of finding winning positions in the solitaire game Tchoukaillon. The periodicity of the pit occupancies in stone winning positions is determined. Given n pits, the number of stones in a winning position is found to be asymptotically bounded by $n^2/\pi$.”
(Ivory Coast), *Ayo* (Nigeria), *Okwe* (Nigeria), b. four-row versions
[*Omweso* (Uganda), *Tshisolo* (Congo / Zaire)].

6-CRO-87
1987 Crowe, Donald: Review of Russ’ *Mancala games* (RUS-84),

6-CUL-94


6-DAN-09

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*Mila* (Institute of African Studies, University of Nairobi), Nairobi (Kenya), Vol. 3, No. 1, 7-17.

6-GAM-80
1980 Gama Amaral, Manuel: Libao, in: M. Gama Amaral, *O povo Yao, Subsídios para o estudo de um povo do noroeste de*
Moçambique [The Yao people, a contribution to the study of people from the Northwest of Mozambique], Instituto de Investigação Científica Tropical, Lisbon (Portugal), 327-332 (in Portuguese).

Describes two variants of libao or mvombwa, a four-row version of the mancala game.

6-ISM-96

Discusses some mathematical aspects of n’tchuva, a four-row ‘mancala’ game played in the South of Mozambique.

6-ISM-02

The first part of the thesis includes an analysis of the mathematical considerations (e.g. mental calculation, geometrical pattern recognition, probability) of tchadji players belonging to the Makhuwa people in the North-East of Mozambique. It compares this four-row version of ‘mancala’ with other versions and a section is dedicated to its history. The second part of the thesis discusses the author’s experience in using the game in teaching probability theory at the university level, and in teaching some elements of probability in upper secondary schools in the north of the country.

6-JAM-00

Presents an introduction to the ‘shax’ three-in-a-row game from Somalia and two other Somali board games ‘Layli Goobaley’ and ‘Korkabood’. It introduces also a computer program for ‘shax’ (see also: www.redsea-online.com/games/shax.html).
Appendix 6


1911  Klamroth, H.: *Afrikanische Brettspiele* [African board games], *Archiv für Anthropologie*, Vieweg (Germany), 253 ff. (in German).


Book and diskette with information on how to play West African versions of the mancala game. In the second part it contains a reproduction of earlier texts and information about its authors: 6-SAW-49 (59-63), 6-MUR-52 (64-90), 6-CUL-94 (91-110), 1-HER-29 (111-120), 1-HER-32 (121-147), 6-BENN-28 (148-159).


Describes briefly some board games from the Sahara and Sahel region.
6-MULL-30

6-MUR-52

6-MVE-90


6-NEW-39

6-NGU-86

Analyses the process of learning the tactics and strategies of the *awelé* game.

6-NGU-88
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Published version of a doctoral thesis submitted in 1991.


Chief Odeleye, a master player, describes ayo, a mancala board game among the Yoruba in Nigeria, and analyses several popular strategies for playing it.


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Presents a brief history and rules of several versions of mancala type games.

6-PAN-82

6-PIN-95

Presents the awele (woaley) game in Ivory Coast.

6-POW-01

Illustrates how oware, a mancala game from the Akan in Ghana, may be explored in the mathematics classroom.

6-POWE-31

6-PRI-92
1992 Prista, António (Ed.): *Jogos de Moçambique* [Games of Mozambique], Instituto Nacional de Educação Física, Maputo (Mozambique) & Centro de Documentação e Informação Amilcar Cabral, Lisbon (Portugal), 79 p. (in Portuguese).

Includes descriptions of the board games muravarava (a three-on-row game, p. 39), and ntchuva (a four-row mancala game, 52-54).

6-PRO-81

Contains sections on three African board games: achi, a three-on-row game from Central Africa (37-39); wari, a mancala game from West
Africa (115-118), and *seega*, a modern version of *senat* from Ancient Egypt (162-166).

6-RAA-72
1972 Raabe, Juliette: *Le jeu de l’awélé* [The awele game], Editions de la Courtille, Paris (France), 96 p. [Ivory Coast]

6-RET-84
1988 Retschitzki, Jean; Keller, Beat & Loesch-Berger, Marie-Cécile: L’influence du matériel et du niveau des joueurs sur la rétention de configurations du jeu d’awélé [The influence of the material and the level of players on the retention of configurations of the awele game], *Cahiers de Psychologie Cognitive*, Université d’Aix-Marseille II, Marseille (France), Vol. 4, No. 4, 335-361 [Ivory Coast].

6-RET-88
1988 Retschitzki, Jean: L’apprentissage des stratégies dans le jeu d’awélé [Learning strategies in the awélé game], in: René Bureau & Denyse du Saivre (Eds.), *Apprentissage et cultures, les manières d'apprendre*, Éditions Karthala, Paris (France), 213-229.

6-RET-90
1990 Retschitzki, Jean: *Stratégies des joueurs d’awélé* [Strategies of the players of awélé], L’Harmattan, Paris (France), 240 p.

Studies the learning of the strategies of the awélé game in Ivory Coast, including an analysis of the use of calculation and estimation (91-98). Presents strategy simulation computer programmes (201-216).

6-RUS-84

*Mancala* is the generic name given by anthropologists to a class of board games played throughout Africa, parts of Asia. Due to the slave trade, the game is also found in the Caribbean and on the eastern coast of South America. The games are played on wooden boards, which have either two, three, or four rows of holes carved into them. When not using boards, the rows of holes may be dug out of the earth. The
book presents the rules, distribution and history of several versions of the *mancala* game.


6-SAND-13

6-SANT-94
1994 Santos Silva, Elísio: *O “ouri” — Um Jogo Caboverdiano e a sua prática em Portugal* [Ouri — A game from Cape Verde Islands and its practice in Portugal], Associação de Professores de Matemática, Lisbon (Portugal), 85 p. (in Portuguese).

This book published by the Association of Mathematics Teachers in Portugal deals with *ouri* (or *seca* or *ouril*), a game of the *mancala* type, as played on the West African Cape Verde Islands and among immigrants in Portugal. It is also compared with other *mancala* type games from the Cape Verde Islands as *pintôn*, and *pia* or *moura*.

6-SANT-95
1995 Santos Silva, Elísio: *Jogos de quadrícula do tipo mancala com especial incidência nos praticados em Angola* [Board games of the mancala type with special attention for those played in Angola], Instituto de Investigação Científica Tropical, Lisbon (Portugal), 323 p. (in Portuguese).


Review: 6-TOW-98.

6-SAW-49
Appendix 6

6-SHA-34

6-SHA-35

6-SHE-94
Includes brief descriptions of *wari* (two-row *mancala* game, p. 6), *achi* (three-on-a-row game, p. 7), *yotê* (West Africa, p. 32), and *el-quirkat* (North Africa, p. 35).

6-TOW-76

6-TOW-77a

6-TOW-77b

6-TOW-77c

6-TOW-79a
6-TOW-79b

6-TOW-79c
1979c Townshend, Philip: *Anthropological Perspectives on Bao (Mankala) Games*, Institute of African Studies, University of Nairobi, Nairobi (Kenya).

6-TOW-82

6-TOW-86

6-TOW-98

6-VOO-95

Analyses the memory feats and calculating skills of master players of the four-row *mankala* game known as *bao* in Zanzibar (Tanzania).

6-VOO-97

Presents mancala boards in the British Museum. Includes bibliographical references and index.
6-VOO-98
Discusses the memory feats and calculating skills of master players of the four-row *mankala* game known as *bao* in Zanzibar (Tanzania).

6-WAG-18

6-WAY-36

6-ZAS-77
Appendix 7

Note on research inspired by the historical reconstruction of mathematical ideas in the ‘sona’ geometric tradition of Southern-Central Africa
(reproduced from AMUCHMA-Newsletter, No. 27, 2003)

Wolfgang Jaritz of the University of Graz (Austria) may have been the first to do mathematical research inspired by the ‘sona’ tradition of the Cokwe and related peoples of eastern Angola and neighboring regions of Zambia and Congo. Informed by the anthropological studies of Gerhard Kubik (cf. KUB-86, 87a, 87b, 87c), Jaritz studied the algorithm for drawing a particular class of ‘sona’ and compared it to the paths of a ball at a billiard table (7-JAR-83). Marcia Ascher of Ithaca College (New York, USA) analyzed several ‘sona’ as graphs (ASC-88, 91 [Ch. 2]). The book (GER-93d, 94i, 95a, 97a) contributed to the historical reconstruction and analysis of mathematical ideas inherent in the ‘sona’ tradition. Gerdes has developed further the geometry of the ‘sona’ introducing the concept of mirror curves and inventing Lunda-designs, presented for the first time in 7-GER-90. Inspired by this research, Slavik Jablan (Belgrade, Serbia) has studied mirror curves and their relationship with mathematical knot theory (7-JAB-95, 01). In the early 1990s Robert Lange (Brandeis University MA, USA) developed ‘sona tiles.’ Franco Favilli and his student Laura Maffei at the University of Pisa (Italy) have been developing software for the construction of mirror curves and Lunda-designs. Mark Schlatter (Centenary College of Louisiana, USA) is studying mirror curves and permutations (7-SCHL-00, 01; 7-PETER-01). Nils Rossing of the University of Science and Technology (Trondheim, Norway) and Christoph Kirfel of the University of Bergen (Norway) applied methods of ‘sona’ analysis by mirror curves to the mathematical analysis of a class of traditional Norwegian rope mats (7-ROS-03). Gerdes himself advanced with the study of Lunda-designs (GER-99a [Ch. 4]; 7-GER-96, 97, 99a, 99b, 02a, 02b, 02e, 02i, 05, 06a, 06b, 07) and a sub-class called Liki-designs (7-GER-02c, 02d). He found several interesting classes of matrices, like cyclic (7-GER-02d), helix (7-GER-02f), cylinder (7-GER-02g) and chessboard matrices (7-GER-02h). Several of these papers were published in Visual Mathematics (*) and other on-line journals. The book 7-GER-07 gives an introduction to cycle matrices.
Links between Lunda-designs, determinants and magic squares were established (7-GER-00, 02i). The newness and the multiple relationships of mathematical ideas arising from the analysis of the ‘sona’ tradition with other areas of mathematics reflects the profoundness and the mathematical fertility of the ideas of the Cokwe master drawers.

For a further update see the appendix “Mathematical research inspired by the *sona* tradition: the example of mirror curves, Lunda-designs and cycle matrices” in GER-06, 217-232.

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2002 A note on chessboard matrices, Visual Mathematics, Belgrade (Serbia), Vol. 4, No. 3 *
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7-GER-02i

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7-JAB-95

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7-PETER-01

7-ROSS-03
2003 Rossing, Nils & Kirfel, Christoph: Matematisk beskrivelse av taumatter [Mathematical description of rope mats], NTNU, Trondheim (Norway).

7-SCHL-00
2000 Schlatter, Mark: Mirror Curves and Permutations (available at: http://personal.centenary.edu/~mschlat/sonaarticle.pdf)

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7-SCHL-05
2005 Schlatter, Mark: How to Create Monolinear Mirror Curves, Visual Mathematics, Belgrade (Serbia), Vol. 7, No. 2 *.

* These papers are available at:
  http://members.tripod.com/vismath/pap.htm
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Accounting mathematics: VERR-00
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