DOWNLOAD PDF MATHEMATICAL TREATISE IN NINE SECTIONS

Chapter 1 : treatise : definition of treatise and synonyms of treatise (English)

The 19th century British Protestant Christian missionary Alexander Wylie in his article Jottings on the Sciences of Chinese Mathematics published in North China Herald , was the first person to introduce Mathematical Treatise in Nine Sections to the West.

In â€" he follwed his father when the latter was transferrd to the Sung capital, Chung-tu now Hangchow. About he served as a sheriff in one of the subprefectures in Szechuan. The treatise is now popularly known as the Shu-shu chiu-chang. It appears that the Shu-shu chiu-chang existed only in manuscript form for several centuries. There was also a handwritten copy of the Shu-shu chiu-chang during the early seventeenth century. Toward the beginning of the nineteenth century this handwritten copy came into the possession of the mathematician Chang Tun-jen and attracted much attention during the time when interest in traditional Chinese mathematics was revived. Many copies were reproduced from the text owned by Chang Tun-jen. Each of the nine sections in the Shu-shu chiu-chang includes two chapters made up of nine problems. These sections do not correspond in any way to the nine sections of the Chiu-hang suan-shu of Liu Hui. The complete text has not yet been translated for investigated in full, although some individual problems have been studied. It had first appeared in Chinese mathematical texts about the fourth century in a problem in the Sun-tzu suan ching; There is an unknown number of things, when counted in threes, they leave a remainder of two; when counted by fives, thy leave a remainder of three; and when counted by sevens, they leave a remainder of two. Fin the number of things. The Suntzu suan ching gives the following solution: There is no explanation of the mathematical method in general, but the algorithmical procedure is given as follows: If you count by threes and have the remainder 2, put If you count by fives and have the remainder 3, put If you count by sevens and have the remainder 2, put Add these numbers, and you get From this subtract , and you have the result. A brief explanation of the procedure follows: For each 1 as a remainder, when counting by threes, put For each 1 as a remainder, when counting by fives, put For each 1 as a remainder, when counting by sevens, put If the sum is or more, subtract from it, and you have the result. The number to be subtracted is, of course, derived from the product of 3, 5 and 7. It gives three different possible answers but no general solution. Since it is in the form of two simultaneous linear equations of three unknowns, i. As early as the middle of the third century. Chinese calendar experts had taken as their starting point a certin date and time in the past known as the Grand Cycle Shang yuan , which was the last time that the winter solstice fell exactly at midnight on the first day of the eleventh month, which also happened to be the first day chia-tzu, cyclical day of a sixty-day cycle. If a denotes the tropical year, R1 the cyclical-day number of the winter solstice i. For several hundred years, calendar experts in China had been working out the Grand cycle fron new astronomical data as it became available. None, however, has passed on the method of computation. The method involves choosing A1, A2,â€¦. The above is valid only under the condition that each difference Ri-Rj is divisble by d, the GCD of the corresponding moduli Ai and Aj, i. The Book of Changes then says: The numbers of the Great Extension [multiplied together] make fifty, of which [only] forty-nine are used [in divination]. He placed the number 1 to the left of each of these numbers, as in Fig. He next removed all the common factors in the original numbers, retaining the only one of each. Each celestial monad was cross-multiplied by the definite base numbers not pertaining to it, giving another set of operation numbers, which were then placed to the left of the corresponding definite base numbers as in Fig. A residue that was not unity was place in the upper-right space on the counting board, with the corresponding definite base number below it. Dividing the definite base number by the residue yielded unity in this case. The space for the definite base number was then filled by the residue of the base number, as shown in Fig. Next the residue of the operation number in the upper right-hand corner was divided by the residue of the base number so that a quotient could be found to give a remainder of unity. If a quotient could not be found, then the process had to be repeated, taking the number in the lower right-hand corner and that in the upper right-hand corner alternately until such a quotient was found. In this case, however, a quotient of 2 would give a remainder of unity, as in Fig. Multiplying the quotient of 2 by the reduced number and adding the result to the celestial monad gave 3, the corresponding multiplier, as in Fig.

These were placed to the left of the corresponding definite base numbers, as in Fig. The operation modulus yen-mu , or the least common multiple, was obtained by multiplying all the definite base numbers together. If common factors had been removed, they had to be restored at this stage. The products of these factors and the corresponding definite base numbers and the reduced use numbers were restored to their original numbers, and the reduced use numbers became the definite use numbers ting-yung-shu , as shown in Fig. The former is the ta yen number, and the latter is the number that was put into use as stated in the Book of Changes. To obtain, N, the definite use numbers were multiplied by the respective remainders given in the problem. Their sum, after it had been diminished repeatedly by the least common factor, would ultimately give the required answer. The Shu-shu chiuchang also is the oldest extant Chinese mathematical text to contain the zero symbol. Some examples are given below 4. The method is identical to that rediscovered by Paolo Ruffini about and by William George Horner in Wang Ling and Joseph Needham have indicated that if the text of the Chiu-changsuan-ching first century is very carefully followed, the essentials of the method are there. In the Shu-shu chiu-chang various values for are used. This last value was first mentioned by Chang Heng in the second century. Formulas giving the areas of various types of geometrical figures are also mentioned in the Shu-shu chiu-chang although some of them are not very accurate. The area, A, of a scalene triangle with sides a, b, and c is obtained from the expression That is, The area, A, of a quadrangle with two pairs of equal sides, a and b, with c the diagonal the figure into two isosceles triangles see Fig. An earlier expression for the area of a segment Fig. For example, a problem in chapter 8 says: Given a circular walled city of unknown diameter with four gates, one at each of the four cardinal points. A tree lies three li north of the northern gate. If one turns and walks eastward for nine li immediately leaving the southern gate, the tree becomes just visible. Find the circumference and the diameter of the city wall. If x is the diameter of the circular wall, c the distance of the tree from the northern gate, and b the distance to be traveled eastward from the southern gate before the tree becomes visible as shown in Fig. The diameters of the opening and the base, a and b; the height, h, of rainwater collected in the basin; and the height, H, of the basin are given. The numbers are set up in vertical columns.

Chapter 2 : Mathematical Treatise in Nine Sections | Revolvy

Qin wrote ShÃ¹shÅ« JiÇ”zhÄ•ng (" Mathematical Treatise in Nine Sections ") in CE. This treatise covered a variety of topics including indeterminate equations and the numerical solution of certain polynomial equations up to 10th order, as well as discussions on military matters and surveying.

When speaking of mathematics in East Asia, it is necessary to take into account China, Japan, Korea, and Vietnam as a whole. At a very early time in their histories, Japan, Korea, and Vietnam all adopted the Chinese writing system, in addition to other cultural institutions. As a result, books produced in any one of these countries could, and actually did, circulate in scholarly circles throughout the region. Scholars versed in mathematics in Japan, Korea, and Vietnam learned at first from Chinese sources, but in time books produced in Japan and Korea found their way to China. Scholars have not determined the extent of any original mathematical developments made in Korea and Vietnam, and whether such advancements made it back to China. After this period, mathematics in the East was under the deep influence of mathematics imported from Europe, which Chinese mathematicians tried to synthesize with traditional Chinese mathematics. This paved the way to the adoption, at the end of the 19th century, of mathematics as it was practiced in the West. Thus, for later mathematical developments in the East, see mathematics: Mathematics in the 19th and 20th centuries. Mathematics in China The textual sources Books written in China from the 1st century bce through the 7th century ce and then in the 13th century formed the foundation for the development of mathematics in East Asia. Most subsequent mathematical works refer to them. References found in the surviving mathematical writings from this period, as well as references made in bibliographies compiled for dynastic annals, indicate that there are many gaps in the textual record. The oldest extant works probably survived because they became official books, taught in the context of the Chinese civil examination system. The most important work in the history of mathematics in Chinese is Jiuzhang suanshu The Nine Chapters on the Mathematical Art , which contains arithmetic, algebraic, and geometric algorithms , presented in relation to problems, some of which evoke the duties of the civil administration: This compilation from the 1st century bce or ce specialists disagree on the exact date of its completion has been restored based on two main sources. The oldest extant copy, which is also the oldest existing mathematics book ever printed, dates from However, only the first five chapters survive. The complete book known today as The Nine Chapters is the result of an 18th-century philological work based on both the former source and exhaustive quotations in a 15th-century Chinese encyclopaedia, Yongle dadian , compiled under the Yongle emperor â€” Most mathematicians referred to it, and most of the subjects that they worked on stemmed from it. Its format, adopted by most subsequent authors, consists of problems for which a numerical answer and a general procedure for solution are given. As with any canonical work, many scholars wrote commentaries on The Nine Chapters, adding explanations and proofs, rewriting procedures, and suggesting new ones. The most important surviving commentary, attributed to Liu Hui 3rd century , contains the earliest Chinese mathematical proofs in the modern sense. Although some people continued to be officially trained as mathematicians thereafter, no advancement in mathematics can be documented until the 11th century. This activity is known only through later quotations, but it probably paved the way for major achievements in the second half of the 13th century. At that time China was divided into North and South, and achievements by mathematicians in both regions are known: Mathematical studies in the North and South seem to have developed independently, but they attest to a common basis. While some major works of the 13th century are recorded in the Yongle dadian, mathematical knowledge quickly deteriorated, as demonstrated by commentaries on these books written by the end of the 15th century that show that they were no longer understood. By the 17th century few ancient Chinese mathematical works were available. Thereafter, as Chinese scholars became aware of European achievements, they began to look for such works throughout the country and strove to interpret them. The end of the 18th century saw a large movement of editing rediscovered texts. These critical editions are the main sources today for the history of Chinese mathematics. Discoveries of new sources are now rare, though in the 20th century a mathematical book was found in a grave sealed before the end of the 2nd century bce, pushing back by centuries the earliest known source on the subject. It is possible that archaeology will bring to light new findings and provoke a revolution comparable to that experienced in the historiography of China in general. The great early period, 1stâ€"7th centuries The Nine Chapters The Nine Chapters presupposes mathematical knowledge about how to represent numbers and how to perform the four arithmetic operations of addition, subtraction, multiplication, and division. In it the numbers are written in Chinese characters, but, for most of the procedures described, the actual computations are intended to be performed on a surface , perhaps on the ground. Most probably, as can be inferred from later accounts, on this surface, or counting board, the numbers were represented by counting rods see the figure that were used according to a decimal place-value system. Numbers represented by counting rods could be moved and modified within a computation. However, no written computations were recorded until much later. As will be seen, setting up the computations with counting rods greatly influenced later mathematical developments. The Nine Chapters contains a number of mathematical achievements, already in a mature form, that were presented by most subsequent books without substantial changes. The most important achievements are described briefly in the rest of this section. Arithmetic of fractions Division is a central operation in The Nine Chapters. Fractions are defined as a part of the result of a division, the remainder of the dividend being taken as the numerator and the divisor as the denominator. The fractional parts are thus always less than one, and their arithmetic is described through the use of division. For instance, to get the sum of a set of fractions, one is instructed to multiply the numerators by the denominators that do not correspond to them, add to get the dividend. Multiply the denominators all together to get the divisor. If there is a remainder, name it with the divisor. Algorithms for areas and volumes The Nine Chapters gives formulas for elementary plane and solid figures, including the areas of triangles, rectangles, trapezoids, circles , and segments of circles and the volumes of prisms, cylinders, pyramids, and spheres. All these formulas are expressed as lists of operations to be performed on the data in order to get the resultâ€"i. For example, to compute the area of a circle, the following algorithm is given: Solution of systems of simultaneous linear equations The Nine Chapters devotes a chapter to the solution of simultaneous linear equationsâ€"that is, to collections of relations between unknowns and data equations where none of the unknown quantities is raised to a power higher than 1. For example, the first problem in this chapter, on the yields from three grades of grain, asks: How many units does a bundle of each grade of grain yield? The procedure for solving a system of three equations in three unknowns involves arranging the data on the computing surface in the form of a table, as shown in the figure. The coefficients of the first equation are arranged in the first column and the coefficients of the second and third equations in the second and third columns. Consequently, the numbers of the first row, comprising the first coefficient in each equation, correspond to the first unknown. This is an instance of a place-value notation, in which the position of a number in a numerical configuration has a mathematical meaning. The main tool for the solution is the use of column reduction elimination of variables by reducing their coefficients to zero to obtain an equivalent configuration. Next, the unknown of the third row is found by division, and hence the second and the first unknowns are found as well. This algorithm is known in the West as Gauss elimination. The algorithm described above relies in an essential way on the configuration given to the set of data on the counting surface. Because the procedure implies a column-to-column subtraction, it gives rise to negative numbers. The Nine Chapters describes detailed methods for computing with positive and negative coefficients that enable problems involving two to seven unknowns to be solved. This seems to be the first occurrence of negative numbers in the history of mathematics. Square and cube roots In The Nine Chapters, algorithms for finding integral parts of square roots or cube roots on the counting surface are based on the same idea as the arithmetic ones used today. These algorithms are set up on the surface in the same way as is a division: Moreover, the algorithms are written out, sentence by sentence, parallel to each other, so that their similarities and differences become clear. Commenting on these algorithms, Liu Hui suggested that one could continue computing the nonintegral portion of a root in the same way, setting 10 as denominator for the first subsequent digit, as denominator for the first two digits, and so on; he thus gave the root in terms comparable to decimal fractions. Moreover, in case the algorithm, which generates digit-by-digit the root of an integer N, did not stop with the digit for the units N was not a perfect square , The Nine Chapters stated that another way of providing the result of the square root algorithm should be used: The quadratic equation appears to have been conceived of as an arithmetic operation with two terms b and c. Moreover, the equation was thought to have only one root. The theory of equations developed in China within that framework until the 13th century. The solution by radicals that Babylonian mathematicians had already explored has not been found in the Chinese texts that survive. However, the specific approach to equations that developed in China occurs from at least the end of the 12th century onward in Arabic sources, where it is meshed with approaches from other parts of the ancient world. Problems involving right triangles Right-angled triangles also constituted a domain in which research continued until the 13th century in China. The so-called Pythagorean theorem is given, under an algorithmic form, in The Nine Chapters. Algorithms are provided to solve various problems on right triangles such as the following: His commentary on the algorithms for computing the volumes of bodies exemplifies the kind of mathematical work that he carried out throughout the book for the sake of exegesis. Liu proved the algorithms already presented in The Nine Chapters, and he also provided and proved new algorithms for the same three-dimensional volumes. In addition, he organized these algorithms, given one after the other without comment in The Nine Chapters, into a system in which proofs for one algorithm use only algorithms that had already been established independently. More precisely, Liu deduced the volume of a solid whose cross sections are circles by circumscribing each section with a square. For example, in comparing the procedures for adding fractions and for solving simultaneous linear equations described above â€”a comparison which is carried out while establishing their correctnessâ€”Liu showed that sets of numbers are involved numerator and denominator for a fraction, the coefficients of an equation for systems of equations which share the property that all the numbers of a set can be multiplied by the same number without altering the mathematical meaning of that set. Both algorithms, Liu showed, proceed by multiplying the sets of numbers that enter into a problem, each by an appropriate factor, in such a way that some corresponding numbers of the sets are made equal and the other numbers are multiplied to keep intact the meaning of the whole sets. In the case of fractions, the denominators are made equal, and the numerators are changed appropriately. For linear equations, the procedure is the same as if two numbers in the same row but in different columns were made equal by an appropriate multiplication, so that one of them can be eliminated through a column-to-column subtraction; the whole columns are then multiplied by the same number so that the equations remain valid. Liu proceeded from these analogies to state new algorithms for the same problems. Nevertheless, it is possible to see an ongoing evolution of some of these topics, such as root extraction and the solution of equations. The underlying procedures were the same, and they were still described in parallel ways, but the new descriptions showed more clearly the underlying mathematical object that is responsible for their similarityâ€”namely, the equation. What changed in the descriptions was that, just as division involved a single divisor, square root extraction was shown to have two divisors and cube root extraction three divisors. These divisors actually are coefficients of the equations that underlie the root extractions. The divisors were shown to play similar roles in the algorithms. Moreover, in setting up the algorithms, the divisors were arranged one above the other, yielding a place-value notation for the underlying equations: However, at that time equations were neither written nor conceptualized in terms of such a place-value notation. Early in the 7th century, Wang Xiaotong generalized the cube root extraction method to solve some third-degree equations using counting rods. It was only much later that the concept and representation of equations begat a full-fledged place-value notation. Suppose one has an unknown number of objects. If one counts them by threes, there remain two of them. If one counts them by fives, there remain three of them. If one counts them by sevens, there remain two of them.

Chapter 3 : Chin Chiu-shao | calendrierdelascience.com

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See the bibliography below. Numerical notation, arithmetical computations, counting rods Traditional decimal notation -- one symbol for each of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, , , and Goes back to origins of Chinese writing. Calculations performed using small bamboo counting rods. The positions of the rods gave a decimal place-value system, also written for long-term records. Arranged left to right like Arabic numerals. Back to B. The digits added merged left to right with carries where needed. Long multiplication similar to ours with advantages due to physical rods. Long division analogous to current algorithms, but closer to "galley method. Describes one of the theories of the heavens. Early Han dynasty B. Book burning of B. States and uses the Pythagorean theorem for surveying, astronomy, etc. Proof of the Pythagorean theorem. Calculations including with common fractions. Collects mathematics to beginning of Han dynasty. Longest surviving and most influential Chinese math book. Ch 1, Field measurement: Ch 2,3,6 on proportions, Cereals, Proportional distribution, Fair taxes. Ch 4, What width?: Describes usual algorithms for square and cube roots but takes advantage of computations with counting rods Ch 5, Construction consultations: Gives elimination algorithm for solving systems of three or more simultaneous linear equations. Involves use of negative numbers red reds for pos numbers, black for neg numbers. Rules for signed numbers. Ch 9, Right triangles: Wrote his mathematical manual. Includes "Chinese remainder problem" or "problem of the Master Sun": Take , 63, 30, add to get , subtract to get Commentary on the Nine Chapters Approximates pi by approximating circles polygons, doubling the number of sides to get better approximations. From 96 and sided polygons, he approximates pi as 3. Originally appendix to commentary on Ch 9 of the Nine Chapters. Includes nine surveying problems involving indirect observations. Includes formula for summing an arithmetic sequence. Also an undetermined system of two linear equations in three unknowns, the "hundred fowls problem" Zu Chongzhi Astronomer, mathematician, engineer. Collected together earlier astronomical writings. Made own astronomical observations. Determined pi to 7 digits: Liu Zhuo Astronomer Introduced quadratic interpolation second order difference method. Wrote Xugu suanjing Continuation of Ancient Mathematics of 22 problems. Solved cubic equations by generalization of algorithm for cube root. Translations of Indian mathematical works. Hindu decimal numerals also introduced, but not adopted. Yi Xing tangent table. Streamlined extraction of square and cube roots, extended method to higher-degree roots using binomial coefficients. Solution of some higher-degree up to 10th equations. Systematic treatment of indeterminate simultaneous linear congruences Chinese remainder theorem. Euclidean algorithm for GCD. Li Yeh Ceyuan haijing Sea Mirror of Circle Measurements , 12 chapters, problems on right triangles and circles inscribed within or circumscribed about them. Yigu yanduan New Steps in Computation , geometric problems solved by algebra. Magic squares of order up through Shou shi li Works and Days Calendar. Solves some higher degree polynomial equations in several unknowns. Rest of outline yet to write. Chronology of Mathematicians and Mathematical Works Early traditional texts These developed in a gradual accumulation of material over centuries. The dates given are roughly when they reached their final form. Suan shu shu A Book on Arithmetic c. A book of bamboo strips found in near Jiangling in Hubei province. Jiuzhang suanshu Nine Chapters of the Mathematical Art c. Zhu Shijie Hanqing, Songting fl. A collection of books in five submissions edited by Xu Guanqi and Li Tianjing with support of many others. It included several works on mathematics: Edited by Ruan Yuan.

Chapter 4 : Chinese overview

The Nine Chapters on the Mathematical Art (simplified Chinese: ä¹•ç« ç®—æœ¯; traditional Chinese: ä¹•ç« ç®—è¡“; pinyin: JiÇ”zhÄ•ng SuÃ nshÃ¹; Wade-Giles: chiu 3 chang 1 suan 4 shu 1) is a Chinese mathematics book, composed by several generations of scholars from the 10th-2nd century BCE, its latest stage being from the 2nd century CE.

Science and Mathematics in Ancient China The sciences of astronomy, physics, chemistry, meteorology, seismology, technology, engineering, and mathematics can trace their early origins to China. Beginning in the 14th Century BC, the Chinese developed a decimal, or base ten system of recording numbers. This is one of the earliest such systems known. There are many notable contributors to the field of Chinese science throughout the ages. After observing the natural process of the inundation of silt and the find of marine fossils in the Taihang Mountains, hundreds of miles from the Pacific Ocean, Shen Kuo devised a theory of land formation, or geomorphology. The Jesuit - China missions of the 16th and 17th centuries learned to appreciate the scientific achievements of this ancient culture and made them known in Europe. Through their correspondence European scientists first learned about the Chinese science and culture. Modern science is indebted to the ancient Chinese scientists in number of ways. Even in disciplines as diverse as physics and social science you will be able to find at least some Chinese influence. In astronomy, the first planetarium was invented by the ancient Chinese. The official astronomers were paid to keep track of the solar, lunar, and planetary motions. In chemistry ancient Chinese chemists with extra ordinary talent used to experiment with number of herbs, animals organs, minerals and many other elements and in the process they invented a range of life saving and healing drugs. In his Bencao Tujing Illustrated Pharmacopoeia , the scholar-official Su Song not only systematically categorized herbs and minerals according to their pharmaceutical uses, but he also took an interest in zoology. For example, Su made systematic descriptions of animal species and the environmental regions they could be found, such as the freshwater crab Eriocher sinensis found in the Huai River running through Anhui, in waterways near the capital city, as well as reservoirs and marshes of Hebei. Experimentation with various materials and ingredients in China during the middle period led to the discovery of many ointments, creams, and other mixtures with practical uses. In a 9th century Arab work Kitab al-Khawass al Kabir, there are numerous products listed that were native to China, including waterproof and dust-repelling cream or varnish for clothes and weapons, a Chinese lacquer, varnish, or cream that protected leather items, a completely fire-proof cement for glass and porcelain, recipes for Chinese and Indian ink, a waterproof cream for the silk garments of underwater divers, and a cream specifically used for polishing mirrors. The expertise of the ancient Chinese in the area of physics led the first among other civilizations to invent complex machines. Their invention and uses of compass or their experimentations with the several aspects of earthquake suggests that they took great interest in the earth science also. Ancient Chinese Mathematics Several factors led to the development of mathematics in China. The geographical nature of the country meant that there were natural boundaries, mountains and seas, which isolated it. On the other hand, when the country was conquered by foreign invaders, they were assimilated into the Chinese culture rather than changing the culture to their own. As a consequence there was a continuous cultural development in China from around BC and it is fascinating to trace mathematical development within that culture. There are periods of rapid advance, periods when a certain level was maintained, and periods of decline. Unlike Greek mathematics there is no axiomatic development of mathematics. The Chinese concept of mathematical proof is radically different from that of the Greeks, yet one must not in any sense think less of it because of this. Rather one must marvel at the Chinese approach to mathematics and the results to which it led. Chinese mathematics was, like the language, very concise. It was very much problem based, motivated by problems of the calendar, trade, land measurement, architecture, government records and taxes. By the fourth century BC counting boards were used for calculating, which effectively meant that a decimal place valued number system was in use. It is worth noting that counting boards are uniquely Chinese, and do not appear to have been used by any other civilisation. It is a book written on bamboo strips and was found near Jiangling in Hubei province. The next important books of which we have records are a sixteen chapter work Suanshu

Computational prescriptions written by Du Zhong and a twenty-six chapter work Xu Shang suanshu Computational prescriptions of Xu Shang written by Xu Shang. Neither of these texts has survived and little is known of their content. It is an astronomy text, showing how to measure the positions of the heavenly bodies using shadow gauges which are also called gnomons, but it contains important sections on mathematics. The method of calculation is very simple to explain but has wide application. This is because a person gains knowledge by analogy, that is, after understanding a particular line of argument they can infer various kinds of similar reasoning Whoever can draw inferences about other cases from one instance can generalise To be able to deduce and then generalize.. Much of Chinese mathematics from this period was produced because of the need to make calculations for constructing the calendar and predicting positions of the heavenly bodies. The most famous Chinese mathematics book of all time is the Jiuzhang suanshu or, as it is more commonly called, the Nine Chapters on the Mathematical Art. The book certainly contains contributions to mathematics which had been made over quite a long period, but there is little in the original text to distinguish the precise period of each. This important work, which came to dominate mathematical development and style for years, is discussed in the article Nine Chapters on the Mathematical Art. Many later developments came through commentaries on this text, one of the first being by Xu Yue about - about although this one has been lost. A significant mathematical advance was made by Liu Hui about - about who wrote his commentary on the Jiuzhang suanshu or Nine Chapters on the Mathematical Art in about Liu Hui, a great mathematician in the Wei Jin Dynasty, ushered in an era of mathematical theorisation in ancient China, and made great contributions to the domain of mathematics. He solved many mathematical problems, pushing his mathematical reasoning further along the dialectical way. Liu Hui gave a more mathematical approach than earlier Chinese texts, providing principles on which his calculations are based. He found approximations to using regular polygons with 3 2n sides inscribed in a circle. His best approximation of was 3. It is clear that he understood iterative processes and the notion of a limit. This was to become one of the themes of Chinese mathematics. In mathematics it was some time before mathematics progressed beyond the depth achieved by Liu Hui. For example Sun Zi about - about wrote his mathematical manual the Sunzi suanjing which on the whole provides little new. However, it does contains a problem solved using the Chinese remainder theorem, being the earliest known occurrence of this type of problem. This text by Sun Zi was the first of a number of texts over the following two hundred years which made a number of important contributions. Its 92 problems illustrate the formula for summing an arithmetic progression. One of the most significant advances was by Zu Chongzhi and his son Zu Geng about - about Zu Chongzhi was an astronomer who made accurate observations which he used to produce a new calendar, the Tam-ing Calendar Calendar of Great Brightness , which was based on a cycle of years. He wrote the Zhui shu Method of Interpolation in which he proved that 3. The beginnings of Chinese algebra is seen in the work of Wang Xiaotong about - about He wrote the Jigu suanjing Continuation of Ancient Mathematics , a text with only 20 problems which later became one of the Ten Classics. He solved cubic equations by extending an algorithm for finding cube roots. His work is seen as a first step towards the "tian yuan" or "coefficient array method" or "method of the celestial unknown" of Li Zhi for computing with polynomials. Interpolation was an important tool in astronomy and Liu Zhuo was an astronomer who introduced quadratic interpolation with a second order difference method. Certainly Chinese astronomy was not totally independent of developments taking place in the subject in India and similarly mathematics was influenced to some extent by Indian mathematical works, some of which were translated into Chinese. Historians argue today about the extent of the influence on the Chinese development of Indian, Arabic and Islamic mathematics. It is fair to say that their influence was less than it might have been, for the Chinese seemed to have little desire to embrace other approaches to mathematics. Early trigonometry was described in some of the Indian texts which were translated and there was also development of trigonometry in China. For example Yi Xing produced a tangent table. From the sixth century mathematics was taught as part of the course for the civil service examinations. Li Chunfeng - was appointed as the editor-in-chief for a collection of mathematical treatises to be used for such a course, many of which we have mentioned above. The collection is now called The Ten Classics, a name given to them in The period from the tenth to the twelfth centuries is one where few advances were made and no mathematical texts from this period survive.

However Jia Xian about - about made good contributions which are only known through the texts of Yang Hui since his own writings are lost. Although Shen Kua - made relatively few contributions to mathematics, he did produce remarkable work in many areas and is regarded by many as the first scientist. The next major mathematical advance was by Qin Jiushao - who wrote his famous mathematical treatise Shushu Jiuzhang Mathematical Treatise in Nine Sections which appeared in He was the first of the great thirteenth century Chinese mathematicians. This was a period of major progress during which mathematics reached new heights. Equations up to degree ten are solved using the Ruffini-Horner method. Li Zhi also called Li Yeh was the next of the great thirteenth century Chinese mathematicians. His most famous work is the Ce yuan hai jing Sea mirror of circle measurements. It contains the "tian yuan" or "coefficient array method" or "method of the celestial unknown" which was a method to work with polynomial equations. He also wrote Yi gu yan duan New steps in computation in which is a more elementary work containing geometric problems solved by algebra. The next major figure from this golden age of Chinese mathematics was Yang Hui about - about He described multiplication, division, root-extraction, quadratic and simultaneous equations, series, computations of areas of a rectangle, a trapezium, a circle, and other figures. He also gave a wonderful account of magic squares and magic circles. Guo Shoujing , although not usually included among the major mathematicians of the thirteen century, nevertheless made important contributions. He produced the Shou shi li Works and Days Calendar , worked on spherical trigonometry, and solved equations using the Ruffini-Horner numerical method. The last of the mathematicians from this golden age was Zhu Shijie about - about who wrote the Suanxue Qimeng Introduction to Mathematical Studies published in , and the Siyuan Yujian True Reflections of the Four Unknowns published in He used an extension of the "coefficient array method" or "method of the celestial unknown" to handle polynomials with up to four unknowns. He also gave many results on sums of series. This represents a high point in ancient Chinese mathematics. Other notable ancient Chinese mathematical discoveries later practiced in the West include: A Refined Pi - The first advanced knowledge of the value of pi originated in China, but was forgotten there in the fourteenth century. When the Jesuits went to China in the seventeenth century, the Chinese were impressed by the European knowledge of pi. By inscribing sides of a polygon in a circle, Liu Hui was able to overtake the Greeks and compute the value to a fifth decimal place at 3. By the fifth century, the value was computed to ten decimal places. In Europe, pi was only approximately calculated to seven places by the year , a full twelve hundred years later. The irrational number pi can be computed to an infinite number of decimal places.

Chapter 5 : Qin Jiushao - Wikipedia

The 19th century British Protestant Christian missionary Alexander Wylie in his article Jottings on the Sciences of Chinese Mathematics published in North China Herald , was the first person to introduce Mathematical Treatise in Nine Sections to the West. in Belgian mathematician Ulrich Librecht published his doctorate dissertation.

His ancestors came from Lu-chun in Shantung province and some biographies quote this incorrectly as his birthplace. In around , when Qin was about seventeen years old, his father was working as a prefect of Bazhou. At this time Qin volunteered for the army, which was putting down a rebellion, and served for a while. He wrote in the preface to his famous work Shushu Jiuzhang see for example [3]: We know that Qin was a rebellious youth, famous for his many love affairs, who disliked authority [1]: In fact Qin did not live in the capital Hang-chou for long since his father was posted to Tongchuan now Santai in Szechwan province in and Qin went there with him. Sadly, we do not know which recluse scholar taught Qin mathematics, but we do know that he studied the Nine Chapters on the Mathematical Art. By Qin was himself the sheriff of a subprefecture in Szechwan province and at this time he was instructed in writing poetry by an official from Chengdu, in central Szechwan province. It is worth noting at this point that as well as being a genius in mathematics and accomplished in poetry, Qin was expert at fencing, archery, riding, music and architecture. However, there was another side to his character. He was described by a contemporary in a letter to the Emperor as [1]: His aggressive nature no doubt suited army life and he became a commander defender while serving in Szechwan province. Genghis Khan, the Mongol leader, died in but the Mongols resumed their attacks on the Han Sung in Their armies invaded Szechwan province in and Qin was forced to leave. He wrote in the preface of Shushu Jiuzhang see for example [3]: We need not feel too sorry for Qin, however, for he was a dishonest rogue who was quite prepared to poison those whom he disliked. He served as an administrator in Qizhou now Qichun in Hupeh province, but his behaviour there was so bad that it cause a military revolt. Then he was appointed governor of Hui-chou now She-hsien in Anhwei province but here he undertook illegal dealings in salt which made him rich. He then moved to Wu-hsing in Chekiang province where he settled down to spend his illegally acquired riches. In the middle of he was posted as a senior administrator to Nanking. After holding this post for three months, his mother died in the September and Qin left his post in Nanking for the mourning period and returned to Hui-chou in Anhwei province where his mother had been living. During his period of mourning in Hui-chou, Qin wrote his famous mathematical treatise Shushu Jiuzhang Mathematical Treatise in Nine Sections which appeared in This is a remarkable work which led to George Sarton writing that Qin was see [1] or [3] where this is quoted: He took up his work in the civil service again in in the capital Hang-chou but resigned after a few months. Appointed governor of Qiongzhou in Hainan in he was dismissed for corruption and exploitation after a hundred days in office and returned home having again acquired immense wealth illegally. One might expect that by this time Qin would be unemployable, given his record of criminal dealings, but he next managed to gain an appointment as an assistant in the district of Yin near Ningpo in Zhekiang where his friend Wu Qian had been appointed as a naval officer. Perhaps Wu Qian was as corrupt as his friend Qin, for he was dismissed from Yin and, in , Qin was also sent away to Meizhou now Meixian , in Guangtong province where he died. We have seen that Qin was a highly unprincipled character but he was also a mathematical genius with few equals. Before looking at his mathematical achievements, let us recount further stories of his character. It is recorded that Qin cheated his friend Wu Qian so that he became the owner of some of his land, and also that Qin punished a female member of his household by confining her without food. Chapter 1 is on indeterminate analysis; it contains remarkable work on the Chinese remainder theorem which occurs right at the beginning of the text. We discuss it below. Chapter 2 is called Heavenly phenomena and it deals with questions on the calendar and also questions about rain or snow. Chapter 3 is called Boundaries of fields and looks at surveying. There is a remarkable formula given in this Chapter which expresses the area of a figure as the root of an equation of degree 4. The novelty here is that the coefficients are not numbers but are functions of lengths in the figure which are left as unspecified. Chapter 4, called Telemetry, looks at problems involving measuring the distance to inaccessible points. Again equations of high degree appear, one problem involving the solution of the equation of degree A tree lies three li north of the northern gate. If one turns and walks eastwards for nine li immediately on leaving the southern gate, the tree just comes into view. Find the circumference and the diameter of the city wall. Qin obtains the equation really an equation of degree 5 in x2, where x2 is the diameter of the city: Throughout the text, in addition to the tenth degree equation above, Qin also reduces the solution of certain problems to a cubic or quartic equation which he solves by the standard Chinese method namely that which today is called the Ruffini - Horner method.

Chapter 6 : Qin_Jiushao biography

The Mathematical Treatise in Nine Sections (simplified Chinese: æ•°ä¹¦ä¹•ç« ; traditional Chinese: æ•¸æ›¸ä¹•ç« ; pinyin: ShÃ¹shÅ« JiÇ”zhÄ•ng; Wade-Giles: Shushu Chiuchang) is a mathematical text written by Chinese Southern Song dynasty mathematician Qin Jiushao in the year

In it he has a general method for solving simultaneous linear congruences the Chinese Remainder Theorem. Compute the product of all the moduli. For each modulus, compute the product of the remaining moduli. For the first, we have 23 times 2 is For the second, we have 9 times 2is For the third, we have 9 times 23 is These could also be found by dividing the product computed in step 1 by the modulus under consideration. For each of the numbers we just found, reduce it modulo the given modulus. For the first, 46 modulo 9 gives 1. For the second, 18 modulo 23 is For the third, modulo 1 is 1. This is the step called finding one. For each of those numbers found in step 3, find the reciprocal modulo the given modulus. For the third, the reciprocal modulo 2 of 1 is 1. To get N sum three numbers. The first is 7 times 46 times 1, which equals , where the 7 is the constant in the first congruence, 46 is the number computed in step 2, and 1 is the number computed in step 4. The second is 13 times 18 times 9, which equals The third is 1 times times 1 which is The answer in step 5 can be reduced modulo the product computed in step 1 to get the final answer. Modulo , reduces to For small a and b this can be done by a quick search. Multiples of 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, etc. Note that 17 is the smallest positive solution, but you can find larger ones by repeatedly adding 21 to Generally, the smallest positive solution is desired. For large a and b a search like that would be very laborious. Start by placing the numbers 1, 0, , and in a square like this: Look in the right column. Subtract the smaller number from the larger , and in the left column add the number to the left of the smaller number, namely 1, to the number to the left of the larger number, namely 0. You get 1 1 Next subtract from while adding the 1 in the lower left to the 1 in the upper left:

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Chapter 7 : Mathematical Treatise in Nine Sections - Wikipedia

In East Asian mathematics: Theory of root extraction and equations Jiushao's Shushu jiuzhang (; "Mathematical Treatise in Nine Chapters") attested to the use of an algorithm extending Jia Xian's procedure to find "the" root of any equation.

Science and technology of the Han Dynasty The full title of The Nine Chapters on the Mathematical Art appears on two bronze standard measures which are dated to CE, but there is speculation that the same book existed beforehand under different titles. The method of chapter 7 was not found in Europe until the 13th century, and the method of chapter 8 uses Gaussian elimination before Carl Friedrich Gauss â€" Its influence on mathematical thought in China persisted until the Qing Dynasty era. Liu Hui wrote a very detailed commentary on this book in He analyses the procedures of the Nine Chapters step by step, in a manner which is clearly designed to give the reader confidence that they are reliable, although he is not concerned to provide formal proofs in the Euclidean manner. Liu credits the earlier mathematicians Zhang Cang fl. Until recent years, there was no substantial evidence of related mathematical writing that might have preceded it, with the exception of mathematical work by those such as Jing Fang 78â€"37 BCE , Liu Xin d. This is no longer the case. It was discovered together with other writings in when archaeologists opened a tomb in Hubei province. It is among the corpus of texts known as the Zhangjiashan Han bamboo texts. From documentary evidence this tomb is known to have been closed in BCE, early in the Western Han dynasty. While its relationship to the Nine Chapters is still under discussion by scholars, some of its contents are clearly paralleled there. The Zhoubi Suanjing , a mathematics and astronomy text, was also compiled during the Han, and was even mentioned as a school of mathematics in and around CE by Cai Yong. Table of contents[edit] Contents of The Nine Chapters are as follows: Areas of fields of various shapes, such as rectangles, triangles, trapezoids, and circles; manipulation of vulgar fractions. Exchange of commodities at different rates; unit pricing; the Rule of Three for solving proportions, using fractions. Distribution of commodities and money at proportional rates; deriving arithmetic and geometric sums. Finding the diameter or side of a shape given its volume or area. Division by mixed numbers ; extraction of square and cube roots ; diameter of sphere , perimeter and diameter of circle. Volumes of solids of various shapes. More advanced word problems on proportion, involving work, distances, and rates. Linear problems in two unknowns solved using the principle known later in the West as the rule of false position. Problems of agricultural yields and the sale of animals that lead to systems of linear equations , solved by a principle similar to Gaussian elimination. Problems involving the principle known in the West as the Pythagorean theorem. Accessibility[edit] Abridged English translation: Arithmetic in Nine Sections,

Chapter 8 : Sacramento Chinese Culture Foundation | Science and Mathematics in Ancient China

The second tradition, Hindu mathematics, includes their arithmetic system based on nine signs and a dot for an empty space, as well as their algebraic methods, an emerging trigonometry, methods in solid geometry, and solutions of problems in astronomy.

Culture Islamic Culture An understanding the medieval Muslim mathematicians requires an understanding of the Arab and Islamic culture in which they lived and worked. Though an accurate and thorough study of a civilization cannot, of course, be completed in a few paragraphs, this page will share a bit of the civilization so Islamic mathematics can be better understood. Muhammad Muhammad was born in Mecca around CE. His father died a few months before his birth, and his mother passed away when he was six years old. Muhammad became a merchant for a wealthy widow Khadijah, who promoted him to the position of managing her trading caravans. Khadijah later proposed to Muhammad, who accepted. She is given credit for reassuring Muhammad of his role as a Prophet of God. Muhammad began preaching Islam, which means "submission" [to God]. Islam is the completion of Christianity and Judaism, and Muhammad is the final and universal Prophet sent by God to all peoples the Seal of the Prophets. His message of monotheism, then, was seen as dangerous to the economy. Muhammad and his followers were forced to flee to Medina, who had offered him a job as a city mediator. This flight is called the hijra. He and his followers also conquered Mecca a few years after the hijra; the capture of Mecca was a blood-less battle, though both Meccans and Medinians suffered heavy losses in battles before this final capture. Shortly after returning to Mecca, Muhammad passed away. He had not designated anyone to succeed him, which resulted in crisis and opposition political camps. The Abbasid Caliphate The Abbasid empire focused on an international identity. The capital was moved to Baghdad, which became the center for learning in the Muslim empire. Scholars from Syria, Iran, and Mesopotamia were brought to Baghdad in the late 8th century, which included Jewish and Christian scholars. The Caliph al-Mansur r. It was in CE that the Sinhind, the first mathematical treatise from India, was brought to Baghdad. This work is called the Sinhind in Arabic, but may refer to the Brahmasphuta Siddhanta, which was influential in the development of Algebra. This text was translated in CE. Among the famous mathematicians employed at the House of Wisdom was al-Khwarizmi. In addition to "compiling the oldest astronomical tables, al-Khwarizmi composed the oldest work on arithmetic and the oldest work on algebra. These were translated into Latin [in the 12th century] and used until the sixteenth century as the principal mathematical textbooks by European universities" Al-Daffa His work also introduced algebra, both the mathematical subject and the word, and Arabic-Indian numerals to Europeans. Mathematics and Culture The mathematics which was absorbed by Muslim scholars came from three primary traditions: Greek mathematics, Hindu mathematics, and practitioner mathematics. It also includes the practical manuals of Heron. The second tradition, Hindu mathematics, includes their arithmetic system based on nine signs and a dot for an empty space, as well as their algebraic methods, an emerging trigonometry, methods in solid geometry, and solutions of problems in astronomy. The third tradition, "mathematics of practitioners," includes the practical mathematics of surveyors, builders, artisans in geometrical design, merchants, and tax and treasury officials. This mathematics was part of an oral tradition which "transcended ethnic divisions and was a common heritage of many of the lands incorporated into the Islamic world" Boyer Medieval Islamic mathematics not only reflected these three sources but also gave a primary importance to the Muslim society that sustained it. Islamic mathematics in the eighth through the thirteenth centuries was marked with a steady development in conic theory in geometry, methods and theories of solving general geometrical problems, treatment and definitions of irrational magnitudes, trigonometry, algebra, and the geometrical analysis of algebra. One important aspect of Islamic mathematics, in contrast to Greek mathematics, is the close relationship between theory and practice. For example, mathematical works discuss solutions to problems which arise when creating modules for use in Islamic tessellations, relating to the Islamic architectural decorative designs Boyer Mathematicians took into account the objections of artisans to their theoretical methods, and artisans also learned to understand the differences between exact and approximate methods. Another example is the mathematical instrument, the astrolabe. It used "the circle-preserving property of stereographic projection to create an analog computer to solve problems of spherical astronomy and trigonometry" Boyer This is a good example of the intersections of mathematical traditions and Islamic culture, as the astrolabe was a Greek invention but Muslims added circles indicating azimuths on the horizon, which proved useful in determining the direction of Mecca. However, the construction of these circles was not just for religious purposes, but instead stimulated geometrical investigations. Mathematics blended together with Islamic culture in a way that is quite distinct from any of the three mathematical traditions from which Muslim mathematicians acquired their knowledge. Please see the "Paper" section for further information on the culture of the medieval Islamic Empire.

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Chapter 9 : Mathematical Treatise in Nine Sections : Wikis (The Full Wiki)

Shiushu jiuzhang (Mathemtaical Treatise in Nine Sections), 81 problems of applied math similar to the Nine Chapters. Solution of some higher-degree (up to 10th) equations. Solution of some higher-degree (up to 10th) equations.

Version for printing Several factors led to the development of mathematics in China being, for a long period, independent of developments in other civilisations. The geographical nature of the country meant that there were natural boundaries mountains and seas which isolated it. On the other hand, when the country was conquered by foreign invaders, they were assimilated into the Chinese culture rather than changing the culture to their own. As a consequence there was a continuous cultural development in China from around BC and it is fascinating to trace mathematical development within that culture. There are periods of rapid advance, periods when a certain level was maintained, and periods of decline. The first thing to understand about ancient Chinese mathematics is the way in which it differs from Greek mathematics. Unlike Greek mathematics there is no axiomatic development of mathematics. The Chinese concept of mathematical proof is radically different from that of the Greeks, yet one must not in any sense think less of it because of this. Rather one must marvel at the Chinese approach to mathematics and the results to which it led. Chinese mathematics was, like their language, very concise. It was very much problem based, motivated by problems of the calendar, trade, land measurement, architecture, government records and taxes. By the fourth century BC counting boards were used for calculating, which effectively meant that a decimal place valued number system was in use. It is worth noting that counting boards are uniquely Chinese, and do not appear to have been used by any other civilisation. It is a book written on bamboo strips and was found near Jiangling in Hubei province. The next important books of which we have records are a sixteen chapter work Suanshu Computational prescriptions written by Du Zhong and a twenty-six chapter work Xu Shang suanshu Computational prescriptions of Xu Shang written by Xu Shang. Neither of these texts has survived and little is known of their content. It is an astronomy text, showing how to measure the positions of the heavenly bodies using shadow gauges which are also called gnomons, but it contains important sections on mathematics. It gives a clear statement on the nature of Chinese mathematics in this period see for example [2]: This is because a person gains knowledge by analogy, that is, after understanding a particular line of argument they can infer various kinds of similar reasoning Whoever can draw inferences about other cases from one instance can generalise To be able to deduce and then generalise.. In fact much Chinese mathematics from this period was produced because of the need to make calculations for constructing the calendar and predicting positions of the heavenly bodies. The most famous Chinese mathematics book of all time is the Jiuzhang suanshu or, as it is more commonly called, the Nine Chapters on the Mathematical Art. The book certainly contains contributions to mathematics which had been made over quite a long period, but there is little in the original text to distinguish the precise period of each. This important work, which came to dominate mathematical development and style for years, is discussed in the article Nine Chapters on the Mathematical Art. Many later developments came through commentaries on this text, one of the first being by Xu Yue about - about although this one has been lost. A significant mathematical advance was made by Liu Hui about - about who wrote his commentary on the Jiuzhang suanshu or Nine Chapters on the Mathematical Art in about Dong and Yao write [24]: He solved many mathematical problems, pushing his mathematical reasoning further along the dialectical way. Liu Hui gave a more mathematical approach than earlier Chinese texts, providing principles on which his calculations are based. It is clear that he understood iterative processes and the notion of a limit. This was to become one of the themes of Chinese mathematics. In mathematics it was some time before mathematics progressed beyond the depth achieved by Liu Hui. For example Sun Zi about - about wrote his mathematical manual the Sunzi suanjing which on the whole provides little new. However, it does contains a problem solved using the Chinese remainder theorem, being the earliest known occurrence of this type of problem. This text by Sun Zi was the first of a number of texts over the following two hundred years which made a number of important contributions. Its 92 problems illustrate the formula for summing an arithmetic progression. One of the most significant advances was by Zu Chongzhi and his son Zu Geng about

- about Zu Chongzhi was an astronomer who made accurate observations which he used to produce a new calendar, the Tam-ing Calendar Calendar of Great Brightness , which was based on a cycle of years. He wrote the Zhui shu Method of Interpolation in which he proved that 3. The beginnings of Chinese algebra is seen in the work of Wang Xiaotong about - about He wrote the Jigu suanjing Continuation of Ancient Mathematics , a text with only 20 problems which later became one of the Ten Classics. He solved cubic equations by extending an algorithm for finding cube roots. His work is seen as a first step towards the "tian yuan" or "coefficient array method" or "method of the celestial unknown" of Li Zhi for computing with polynomials. Interpolation was an important tool in astronomy and Liu Zhuo was an astronomer who introduced quadratic interpolation with a second order difference method. Certainly Chinese astronomy was not totally independent of developments taking place in the subject in India and similarly mathematics was influenced to some extent by Indian mathematical works, some of which were translated into Chinese. Historians argue today about the extent of the influence on the Chinese development of Indian, Arabic and Islamic mathematics. It is fair to say that their influence was less than it might have been, for the Chinese seemed to have little desire to embrace other approaches to mathematics. Early trigonometry was described in some of the Indian texts which were translated and there was also development of trigonometry in China. For example Yi Xing produced a tangent table. From the sixth century mathematics was taught as part of the course for the civil service examinations. Li Chunfeng - was appointed as the editor-in-chief for a collection of mathematical treatises to be used for such a course, many of which we have mentioned above. The collection is now called The Ten Classics , a name given to them in The period from the tenth to the twelfth centuries is one where few advances were made and no mathematical texts from this period survive. However Jia Xian about - about made good contributions which are only known through the texts of Yang Hui since his own writings are lost. Although Shen Kua - made relatively few contributions to mathematics, he did produce remarkable work in many areas and is regarded by many as the first scientist. The next major mathematical advance was by Qin Jiushao - who wrote his famous mathematical treatise Shushu Jiuzhang Mathematical Treatise in Nine Sections which appeared in He was the first of the great thirteenth century Chinese mathematicians. This was a period of major progress during which mathematics reached new heights. Equations up to degree ten are solved using the Ruffini - Horner method. Li Zhi also called Li Yeh was the next of the great thirteenth century Chinese mathematicians. His most famous work is the Ce yuan hai jing Sea mirror of circle measurements written in It contains the "tian yuan" or "coefficient array method" or "method of the celestial unknown" which was a method to work with polynomial equations. He also wrote Yi gu yan duan New steps in computation in which is a more elementary work containing geometric problems solved by algebra. The next major figure from this golden age of Chinese mathematics was Yang Hui about - about He described multiplication, division, root-extraction, quadratic and simultaneous equations, series, computations of areas of a rectangle, a trapezium, a circle, and other figures. He also gave a wonderful account of magic squares and magic circles. Guo Shoujing , although not usually included among the major mathematicians of the thirteen century, nevertheless made important contributions. He produced the Shou shi li Works and Days Calendar , worked on spherical trigonometry, and solved equations using the Ruffini - Horner numerical method. The last of the mathematicians from this golden age was Zhu Shijie about - about who wrote the Suanxue qimeng Introduction to mathematical studies published in , and the Siyuan yujian True reflections of the four unknowns published in He used an extension of the "coefficient array method" or "method of the celestial unknown" to handle polynomials with up to four unknowns. He also gave many results on sums of series. This represents a high point in ancient Chinese mathematics. The decline in Chinese mathematics from the fourteenth century was not by any means dramatic. The Nine Chapters on the Mathematical Art continued to be the model for mathematical learning and new works based in it continued to appear. Wu Jing was an administrator in the province of Zhejing and his arithmetical encyclopaedia contained all the problems of the Nine Chapters. Again Cheng Dawei - published the Suanfa tong zong General source of computational methods in which is written in the style of the Nine Chapters on the Mathematical Art but provides an even larger collection of problems. The books we have just listed show mathematical activity, but they did not take forward the methods of polynomial algebra. On the contrary, the deep works of the 13th century ceased to be even understood much less developed further. Xu Guangqi - certainly recognised exactly this and offered possible explanations including scholars neglecting practical computational tools and an identification of mathematics with mystical numerology under the Ming dynasty. Other factors must be that the books describing the advanced methods were, in the Chinese tradition, very terse, and without teachers to pass on an understanding it became increasingly difficult for scholars to learn directly from the texts. Xu Guangqi was the first native of China to publish translations of European books in Chinese. Collaborating with Matteo Ricci he translated Western books on mathematics, hydraulics, and geography. Certainly this does not mark the end of the Chinese mathematics tradition, but from the time of Matteo Ricci and other Western missionaries China was greatly influenced by other mathematical traditions. It is impossible in an article of this length to mention many of the numerous contributions from this period on. Let us mention one important family, however, namely the Mei family. The most famous member of this family was Mei Wending and his comment on the golden section is typical of the sensible attitude he took towards Western mathematics see for example [9]: Mei chose not to take a government post as most mathematicians did, but rather decided to devote himself to mathematics and its teaching. He travelled widely throughout China and gained great fame leading to many people becoming his pupils. Two of his brothers, Mei Wenmi and Mei Wennai, worked on astronomy and mathematics. Mei Wending was assisted later in his life by his son Mei Yiyan. Certain people from the eighteenth century onwards did an excellent job in recording the Chinese tradition so that much of it is still accessible to us today. For example Dai Zhen - became an editor for the Siku quanshu Complete library of the four branches of literature which was a project set up by Emperor Qianlong in He edited a new edition of the Nine Chapters on the Mathematical Art after copying the complete text as part of this project. Ruan Yuan - produced his famous work the Chouren zhuan or Biographies of astronomers and mathematicians containing biographies of Chinese and 41 Western "mathematicians". Many biographical details of Chinese mathematicians recorded in this Archive are known through this work. Li Rui - assisted Ruan Yuan. He was a highly productive mathematician who died when at the height of his abilities. His most important work is Lishi suan xue yi shu Collected mathematical works of Li Rui.