

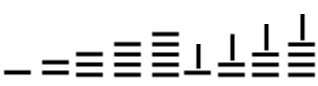
# Who says Chinese mathematicians are idiots?

It is generally agreed that the development of mathematics is one part of western civilization. So, there is a common belief which is that, Europe is the cradle of the advancement of mathematics. But the fact is that, when many people are admiring the mathematical genius of Newton, Euler, Pythagoras and Descartes, in the ancient China there were a number of great mathematicians who have spent their whole lives exploring the mysteries behind numbers.

## Numerical notation, arithmetical computations, counting rods (算筹)

- Traditional decimal notation -- one symbol for each of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 100, 1000, and 10000. Ex. 2034 would be written with symbols for 2, 1000, 3, 10, 4, meaning 2 times 1000 plus 3 times 10 plus 4. (二千零三十四)
- Calculations performed using small bamboo counting rods. The positions of the rods gave a decimal place-value system, also written for long-term records. 0 digit was a space. Arranged left to right like Arabic numerals. Back to 400 B.C.E. or earlier.
- Addition: the counting rods for the two numbers placed down, one number above the other. The digits added (merged) left to right with carries where needed. Subtraction similar.
- Multiplication: multiplication table to 9 times 9 memorized. (九因歌) Long multiplication similar to modern method with advantages due to physical rods. Long division analogous to current algorithms, but closer to "galley method."

Vertical form (縱式): 

Horizontal form (橫式): 

	<b>Warring States</b>	403
	<b>Qin</b>	221 206
<b>Zhoubi suanjing</b> <b>Nine Chapters</b>	<b>Han</b>	B.C.E. C.E.
	<b>Three Kingdoms</b>	220 280
<b>Lui Hui</b>	<b>Jin</b>	
	<b>Northern and Southern Dynasties</b>	420 581
<b>Zu Chongzi</b> <b>Zhen Luan</b>	<b>Sui</b>	618
<b>Wang Xiaotong</b>	<b>Tang</b>	
	<b>5 Dynasties</b>	907 960
<b>Jia Xian</b> <b>Shen Kuo</b> <b>Li Zhi</b> <b>Qin Jiushao</b> <b>Guo Shoujing</b> <b>Yang Hui</b> <b>Zhu Shijie</b>	<b>Song</b>	
	<b>Yuan</b>	1279 1368
	<b>Ming</b>	
<b>Intro of Western Math</b> <b>Mei Wending</b> <b>Chen Shiren</b> <b>Ming Antu</b> <b>Wang Lai</b> <b>Li Shanlan</b>	<b>Qing</b>	1644 1911

## Some great ancient Chinese mathematicians and their most influential works

### The Nine Chapters on the Mathematical Art (《九章算術》)

It is one of *The Ten Books On Mathematical Art* (算經十書). It collects mathematics early to the beginning of Han dynasty. It was finished between 50A.D. and 100A.D.. Moreover, it is the longest surviving and the most influential Chinese math book. The 9 chapters are briefly outlined as follows:

1. Field measurement( 方田章 ): systematic discussion of algorithms using counting rods for common fractions including algebra for GCD, LCM; areas of plane figures, square, rectangle, triangle, trapezoid, circle, circle segment, sphere segment, annulus -- some accurate, some approximations.
2. Cereals ( 粟米章 ): includes some calculations on exchange of food, proportional distribution.
3. Proportion( 衰分章 ): includes some techniques involving proportional distribution, A.P. & G. P.
4. width ( 少廣章 ): given area or volume find sides. Describes usual algorithms for square and cube roots but takes advantage of computations with counting rods
5. Construction consultations ( 商功章 ): volumes of cube, rectangular parallelepiped ( 平行六面體 ), prism frustums, pyramid, triangular pyramid, tetrahedron, cylinder, cone, and conic frustum, sphere -- some approximations, some use  $\pi = 3$
6. Transportation ( 均輸章 ): about reasonable transportation and even division
7. Excess and deficient ( 盈不足章 ): false position and double false position
8. Rectangular arrays ( 方程章 ): Gives elimination algorithm for solving systems of three or more simultaneous linear equations. Involves use of negative numbers (red rods for positive numbers, black for negative numbers). Rules for signed numbers.
9. Right triangles( 勾股章 ): applications of Pythagoras' theorem and similar triangles, solves quadratic equations with modification of square root algorithm, only equations of the form  $x^2 + ax = b$ , with  $a$  and  $b$  positive.

The complete content of this great work can be found here:

[http://mikekong.uhome.net/Maths/Databases/9\\_chapters\\_intro.html](http://mikekong.uhome.net/Maths/Databases/9_chapters_intro.html)

If you want some examples and explanation of the principles, the following will be helpful to you:

<http://www.math.tku.edu.tw/mathhall/mathinfo/lwymath/ninechapter.htm>

## Pascal triangle? We invented first!!!

It is generally accepted that the Pascal triangle was invented by Blaise Pascal. However, it's a delusion!! Undoubtedly he is the person who invented the first addition calculator, but the thing is, that so-called “Pascal triangle”, was already invented by a Chinese mathematician, *Jia Xian* (賈憲) about 600 years earlier and was first mentioned in his *huangdi jiujiang xichao* (《黃帝九章細草》) (already lost). And because it's mentioned later in *Yang Hui* (楊輝)'s *The Nine Chapters on the Mathematical Art* (《九章算術》), the “Pascal” triangle is also known as “*jia xian triangle*” (賈憲三角) or “*yang hui triangle*” (楊輝三角).

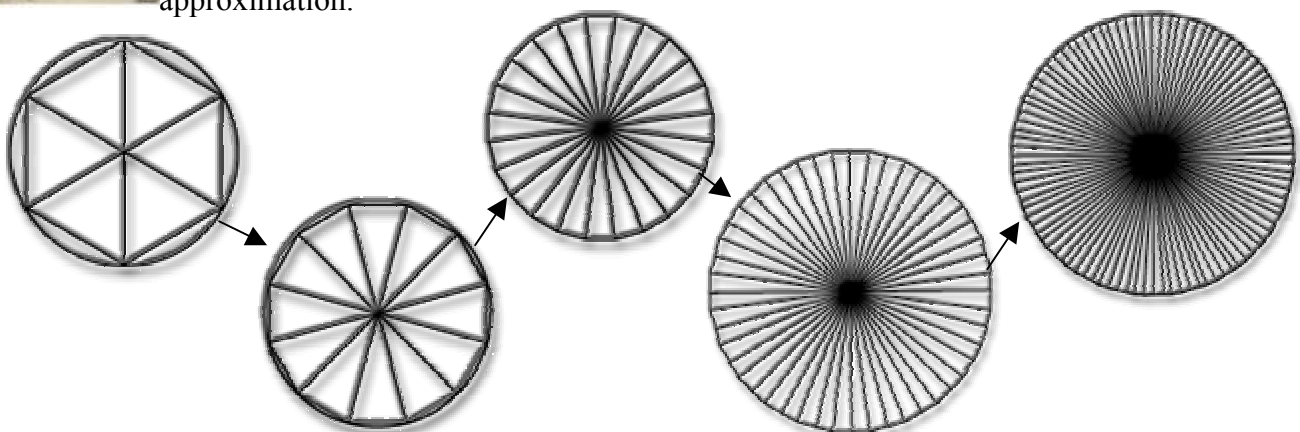
$(a+b)^0 =$	1	1
$(a+b)^1 =$	$a+b$	1 1
$(a+b)^2 =$	$a^2+2ab+b^2$	1 2 1
$(a+b)^3 =$	$a^3+3a^2b+3ab^2+b^3$	1 3 3 1
$(a+b)^4 =$	$a^4+4a^3b+6a^2b^2+4ab^3+b^4$	1 4 6 4 1
$(a+b)^5 =$	$a^5+5a^4b+10a^3b^2+10a^2b^3+5ab^4+b^5$	1 5 10 10 5 1
$(a+b)^6 =$	$a^6+6a^5b+15a^4b^2+20a^3b^3+15a^2b^4+6ab^5+b^6$	1 6 15 20 15 6 1

## Can you find the value of $\pi$ without using calculators and computers?

The measurement and calculations of circle is an indispensable aspect in geometry. The ratio of circumference to diameter of a circle, i.e.  $\pi$ , is a stepping-stone of the development of mathematics—from “straight” to “curve” measurement, from “definite” to “infinity”...



*Liu Hui* (劉徽) is the first Chinese mathematician who stated the approximate value of  $\pi$ , he stated *the principle of exhaustion for circles* (割圓法). From 96 and 192 sided polygons, he approximated  $\pi$  as 3.141014 and suggested 3.14 as a practical approximation.





About 200 years later, another Chinese mathematician *Zu Chongzhi* (祖冲之), managed to find the value of  $\pi$  as accurate as 7 decimal places. He stated that the value of  $\pi$  should be between 3.1415926 and 3.1415927. he also stated a close approximation of 355/113 and a rough approximation of 22/7. Wow, Chinese mathematicians are not idiots!!

What is more, this guy did many experiments with his son and finally obtained the accurate formula for calculating the volume of sphere.

$$\text{Volume of sphere} = \frac{\pi}{6} D^3$$

where D = diameter of sphere

Unbelievable, right?

## Conclusion

Being a Chinese, I feel honored for being a member of a race with such a long history and so many intelligent people. Although I can't tell that the Chinese are the best at this moment, it's possible that Chinese mathematicians will try their best in exploring on the gigantic field of numbers and unfold all the mysteries behind them. And this is the goal we are striving toward!!

## Reference websites

Try out the virtual abacus here!

<http://qi-journal.com/culturearticles/abacusindex.html>

Learn more about the method of exhaustion for circles (割圆术)

[http://episte.math.ntu.edu.tw/articles/mm/mm\\_03\\_2\\_08/](http://episte.math.ntu.edu.tw/articles/mm/mm_03_2_08/)

The story of Zu Chongzhi (祖冲之)

[http://pei.cjhh.tc.edu.tw/chem\\_39\\_10.htm](http://pei.cjhh.tc.edu.tw/chem_39_10.htm)

Converting Arabic numbers to Chinese numbers by the computer

<http://www.mandarintools.com/numbers.html>

Chinese numerology (See how Chinese number is in the eyes of foreigners!!)

<http://www.chcp.org/Vnumbers.html>

history of Chinese mathematics

[http://residence.educities.edu.tw/f89511f125/new\\_page\\_6.htm](http://residence.educities.edu.tw/f89511f125/new_page_6.htm)

