History of Mathematics

Math 395 Spring 2010 | Fowler 310 MWF 10:30am - 11:25am

http://faculty.oxy.edu/ron/math/395/10/

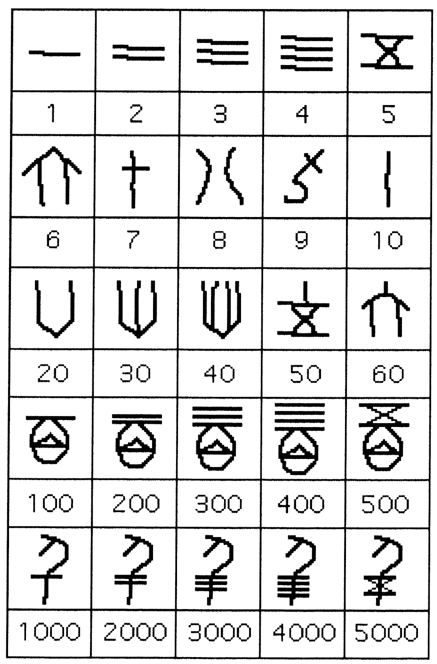
Class 13: **Monday February 22**

TITLE Chinese Mathematics
CURRENT READING: Katz, §7
NEXT READING: Katz, §8

Homework #5 DUE Monday March 1
Katz, p. 168: #2,#20. p.191: 7, 11, 21. EXTRA CREDIT: page 168, #4.

SUMMARY
Today we will begin looking at the mathematical contributions from ancient China.

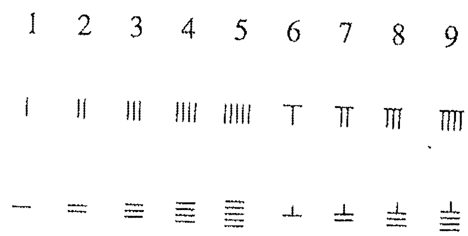
Number System
The Chinese number system was decimal, similar to the Egyptian one, with many different symbols used. However, in the Chinese system there were separate symbols for the first 9 digits AND some multiples of ten. (Recall that the Egyptian Hieroglyphic number system just had independent symbols for powers of 10.)



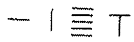
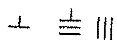
EXAMPLE

What number does  represent? How would you represent the number 3282?

Katz reports that the Chinese apparently also represented numbers using small bamboo rods, called counting rods in a decimal place system. They represented negative numbers by using different colors. When a particular place was empty it would be denoted by a small dot (representing zero).



Exercise

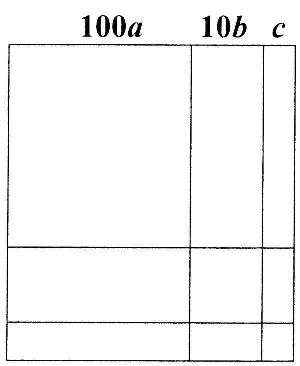
 represents 1156 while 

Nine Chapters on the Mathematical Art (Jiuzhang suanshu)

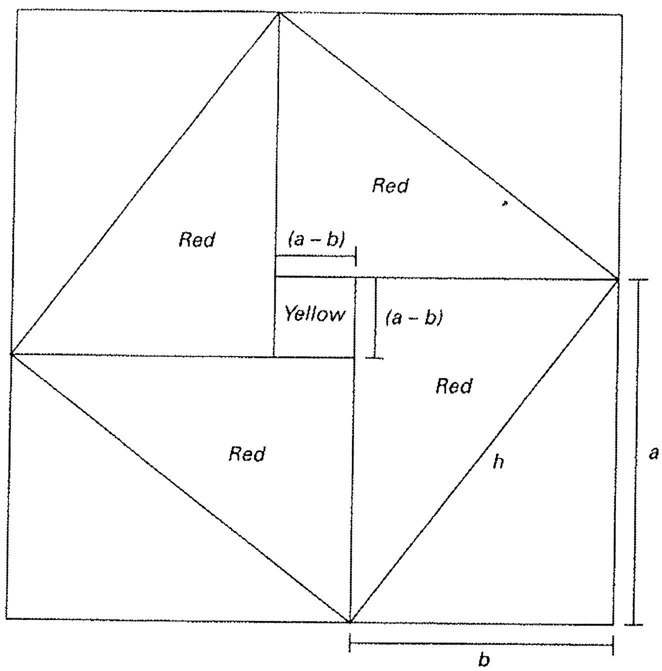
The most famous of Ancient Chinese mathematical works is *Jiuzhang suanshu* which is primarily know from the version commented on by Liu Hui in the Third Century CE.

GroupWork

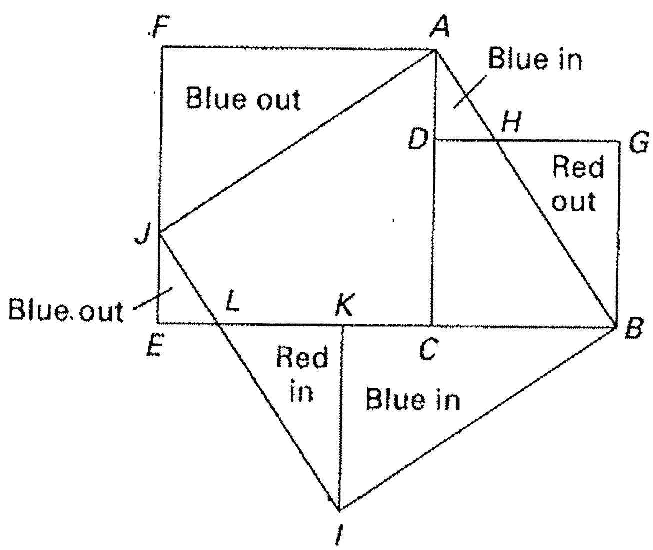
Let's replicate the Chinese square root algorithm to evaluate "the side of a square of area 55,225"



The *gougu* Rule (Pythagoras' Theorem)
Katz gives two different proofs of Pythagoras theorem, one due to Zhao Shuang in *Arithmetic Classic of the Gnomon*



And Hui's proof



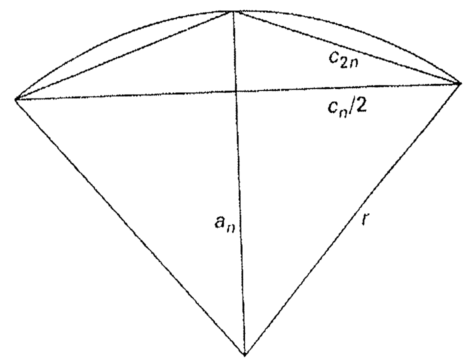
Standards of Proof

What can we say about the standard of proof used by Chinese mathematicians as compared to the Greeks and modern standards?

Calculation of Pi

$$a_n = \sqrt{r^2 - \left(\frac{c_n}{2}\right)^2} \quad \text{and} \quad c_{2n} = \sqrt{\left(\frac{c_n}{2}\right)^2 + (r - a_n)^2}.$$

$$S_{2n} = 2n\frac{1}{2}\frac{c_n}{2}r = \frac{1}{2}nrc_n.$$



By computing the area of a regular-sided n-gon, S_n, and the corresponding $2n$-gon, Liu was able to approximate π by using r=10 and n=96 to obtain $\pi \sim 3.141024$.
Later, Zu Chingzhi (c. 429-500) continued the calculations using n=24576 to obtain $\pi \sim 3.1415926$

Magic Square
The earliest known magic square was found by the Chinese (Struik, *On Ancient Chinese Mathematics*)

4	**9**	**2**
3	**5**	**7**
8	**1**	**6**

The search for other magic squares apparently lead to the solution of linear systems of equations and a method very similar to Gaussian elimination.

$$3x+2y+z=39$$
$$2x+3y+z=34$$
$$x+2y+3z=26$$

becomes

1	2	3
2	3	2
3	1	1
26	34	39

0	0	3
0	5	2
36	1	1
99	24	39

Which corresponds to $3x+2y+z=3$, $5y+z=24$, $36z=99$.