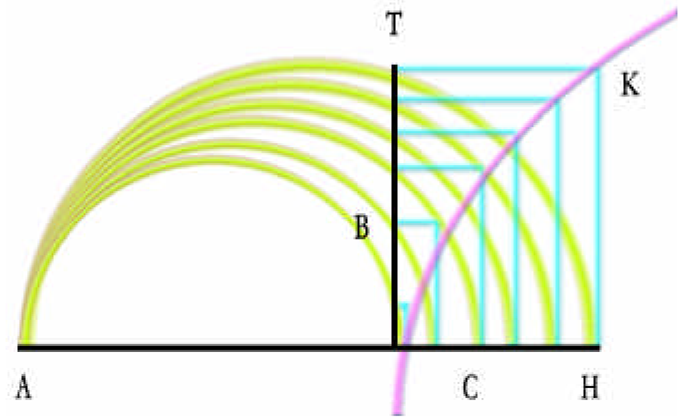
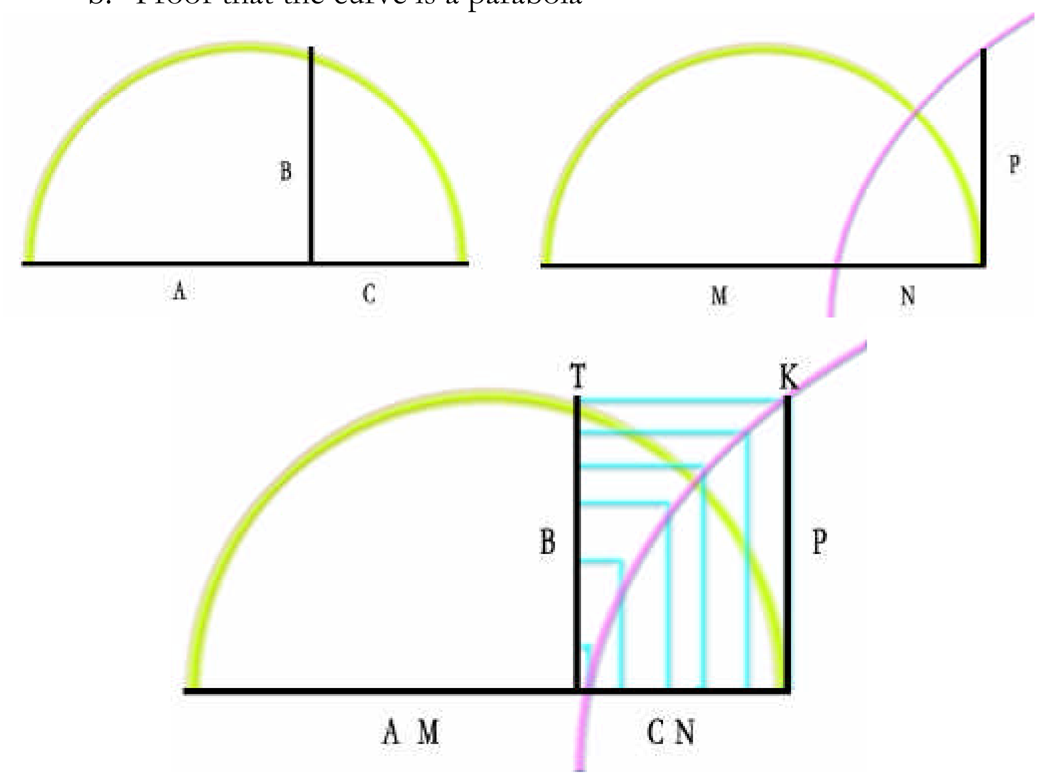
C. Wood
History of Mathematics – Assignment 3
Islamic and Chinese Mathematics
Professor Van Brummelen
Due Friday, May 16, 2003

1. Ibrahim ibn Sinan's Conic Curves

   a. Location of the path of the parabola



   b. Proof that the curve is a parabola



If $ac = b^2$ and $mn = p^2$ then M=A, N=C and B=P.

2. Jamshid al-Kashi

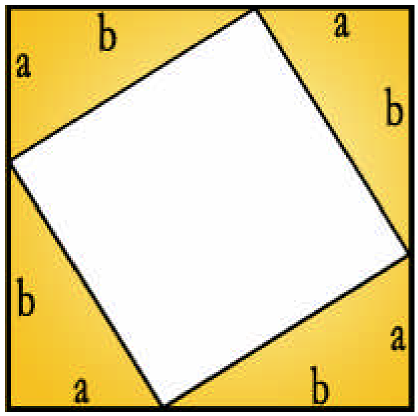
a. Approximation for p based on a polygon with 1536 sides

Number of Sides $S_n = S_{n-1} + 2$	c_n $\sqrt{C_{n-1}+2}$	a_n $\sqrt{4-C_n^{\ 2}}$	Estimate of p $(S_n * a_n)/2)$
6	$\sqrt{3}$	1	3
12	1.93185	0.517638	3.105828541
24	1.98289	0.261052	3.132628613
48	1.99572	0.130806	3.139350203
96	1.99893	0.065438	3.141031951
192	1.99973	0.032723	3.141452472
384	1.99993	0.016362	3.141557608
768	1.99998	0.008181	3.141583892
1536	2	0.004091	3.141590463

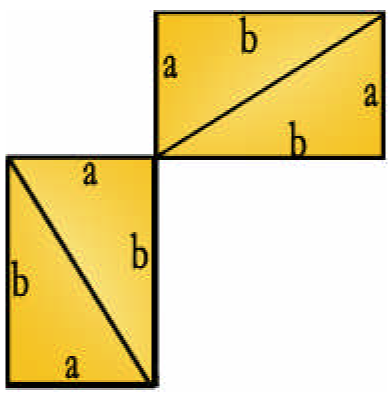
b. Approximation for p based on a hexagon with 128 sides

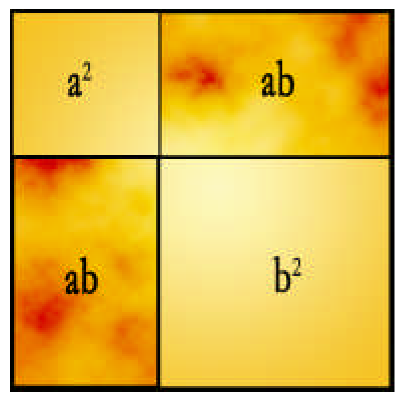
Number of Sides $S_n = S_{n-1} + 2$	c_n $\sqrt{C_{n-1}+2}$	a_n $\sqrt{4-C_n^{\ 2}}$	Estimate of p $(S_n * a_n)/2)$
4	$\sqrt{2}$	1.414214	2.828427125
8	1.84776	0.765367	3.061467459
16	1.96157	0.390181	3.121445152
32	1.99037	0.196034	3.136548491
64	1.99759	0.098135	3.140331157
128	1.9994	0.049082	3.141277251

3. Earlier Indian and Chinese "proofs" of the Pythagorean Theorem
    a. Bhaskara's proof: Take the area of the whole square and subtract the four triangles from it.

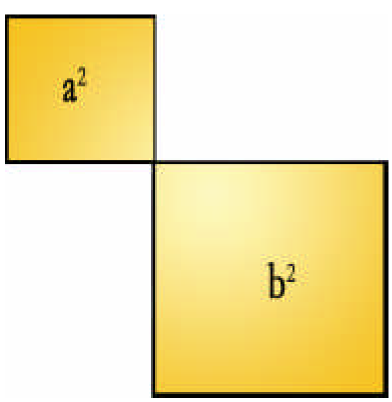


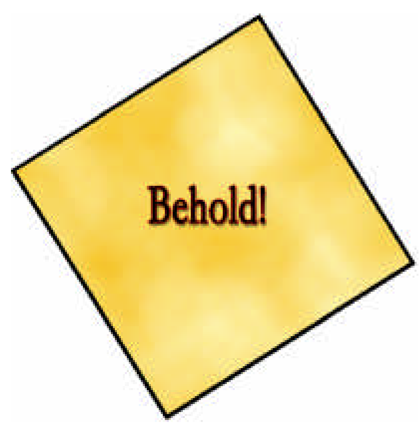
$$(a+b)^2 = -4\left(\left(\frac{1}{2}\right)ab\right)$$





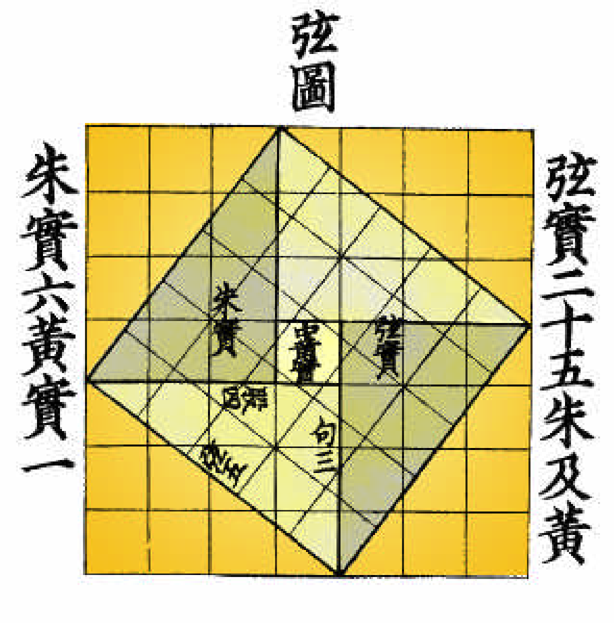
$$= a^2 + 2ab + b^2 - 2ab$$

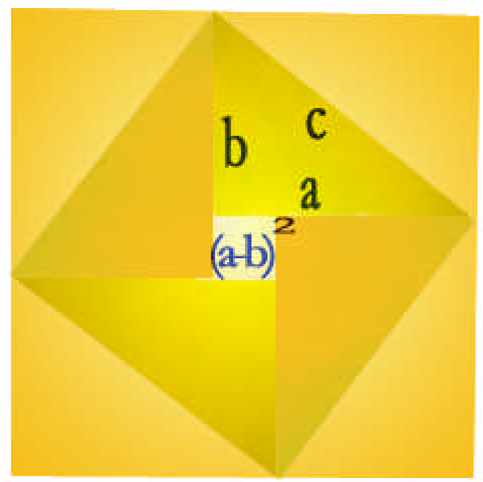




$$= a^2 + b^2$$

i. Lui Hui's proof: Find the area by adding up the five regions inside of the oblique square.





$$c^2 = (a-b)^2 + 4(ab \div 2)$$
$$c^2 = a^2 + b^2 - 2ab + 2ab$$
$$c^2 = a^2 + b^2$$

4. Yang Hui's method to find the cube root of 74,088:

$\sqrt[3]{74,088}$

BestGuess

$x^3 = 10^3 = 1,000$

$x^3 = 20^3 = 8,000$

$x^3 = 30^3 = 27,000$

$x^3 = 40^3 = 64,000$

$x^3 = 50^3 = 125,000$

$x = 4\underline{y}$

$x^3 = 74,088$

Initial guess is $x = 40$

Pascal's ? ³ Number = 1331

$1 = 1$

$3x^2 = 120$

$3x^3 = 4800$

$74,088 - x^3 = 10,088$

Equation to find next digit is:

$y^3 + 120y^2 + 4800y = 10,088$

$\sqrt[3]{74,088}$

BestGuess

$y^3 = 1^3 = 4,921$

$y^3 = 2^3 = 10,088$

$y^3 = 3^3 = 15,507$

$xy = 42$