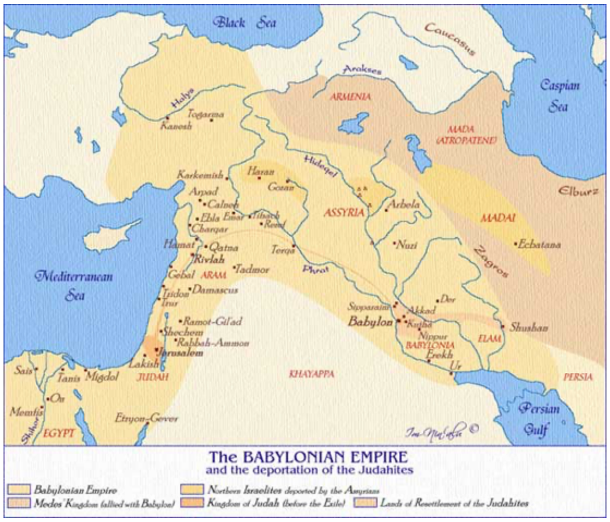
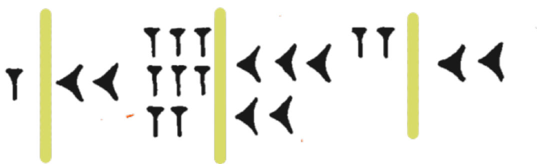
Babylonian Cuneiform Script



Mesopotania = land between the rivers

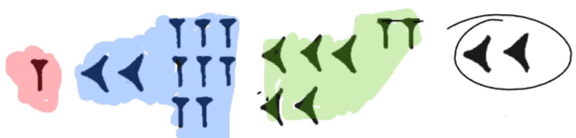
3000 BC: Babylonians developed a form of picture writing, but instead of pen and ink used a stylus to make impressions in clay. (Clay dries quickly but is durable, vs. Chinese writing which was much less durable).

The stylus had a triangular shape with a sharp edge so the combined effect was



$1 * 60^3 + 28 * 60^2 + 52 * 60 + 20$

Positional numbering system



60^3 60^2 60^1 60^0

$= 319940$

Plimpton 322 - 1800 BCE - Babylonia / Iraq

Plimpton 322 - 1800 BC - Babylonia / Iraq

d w | INDEX

line 11 ——

Cuneiform tablet

Stylus

$\frac{45}{60^2} = \frac{9 \cdot 5}{60 \cdot 60}$

$= \frac{3}{20} \cdot \frac{1}{12}$

$= \frac{1}{80}$

$\frac{33}{60} = \frac{11}{20}$

$\frac{45}{80} = \frac{9}{16}$

$1 + \frac{9}{16} = \frac{25}{1}$

Sexigesimal Number System:

Idea: $3;15 = 3 + \frac{15}{60}$ or $3,15$

Ex line 11 ——————————

Width Column: [cuneiform] $= 45$

Diagonal Column: $1,15 = 1 \cdot 60^1 + 15 \cdot 60^0 = 75$

Note: set $d = 75$, $w = 45$, compute $d^2 - w^2 =$

get: $l = 3600$

$45 \cdot 60^0$

$\frac{45}{60}$

First Column: $\frac{d^2}{l^2} =$

ex: Row 11: Left Col = 1.5625

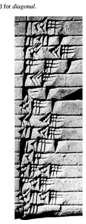
Column two. The heading of the second column includes the word for *width*.

$\cdot 60^n$ $\frac{1}{60^n}$

1,59	119
56,7	3367
1,16,41	4601
3,31,49	12709
1,5	65
5,19	319
38,11	2291
13,19	799
9,1 [8,1]	541[481]
1,22,41	4961
45	45
27,59	1679
7,12, 1 [2,41]	25921[161]
29,31	1771
56	56

$\frac{45}{60} = \frac{3}{4}$

Column three. The heading of the third column includes the word for *diagonal*.



2,49	169
3,12,1 [1,20,25]	11521 [4825]
1,50,49	6649
5,9,1	18541
1,37	97
8,1	481
59,1	3541
20,49	1249
12,49	769
2,16,1	8161
1,15	75
48,49	2929
4,49	289
53,49	3229
53 [1,46]	53 [106]

$60 + 15$

$1 + \frac{15}{60} = 1 + \frac{1}{4} = \frac{5}{4}$

Column one. The heading of the first column has not been translated. We shall see in a moment the reasons for placing the `decimal point'.

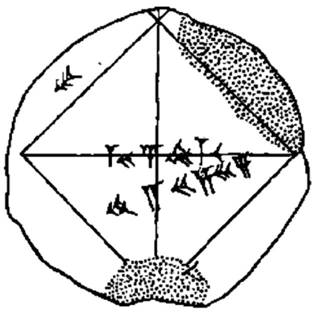
1,59,0,15	1.9834 ...
1,56,56,58,14,50,6,15	1.94916 ...
1,55,7,41,15,33,45	1.9188 ...
1,53,10,29,32,52,16	1.88625 ...
1,48,54,1,40	1.81501 ...
1,47,6,41,40	1.78519 ...
1,43,11,56,28,26,40	1.71998 ...
1,41,33,59,3,45	1.6928 ...
1,38,33,36,36	1.64267 ...
1,35,10,2,28,27,24,26	1.58612 ...
1,33,45	1.5625 ...
1,29,21,54,2,15	1.48942 ...
1,27,0,3,45	1.45002 ...
1,25,48,51,35,6,40	1.43024 ...
1,23,13,46,40	1.38716 ...

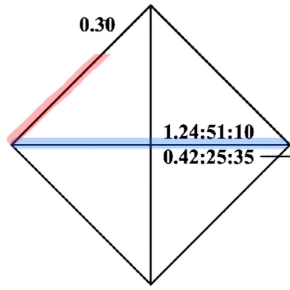
Note:

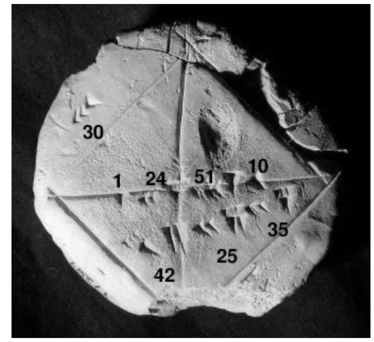
$\left(\frac{5}{4}\right)^2 - \left(\frac{3}{4}\right)^2 = \frac{25 - 9}{16} = 1^2$:)

https://personal.math.ubc.ca/~cass/courses/m446-03/pl322/pl322.html

1800 BC







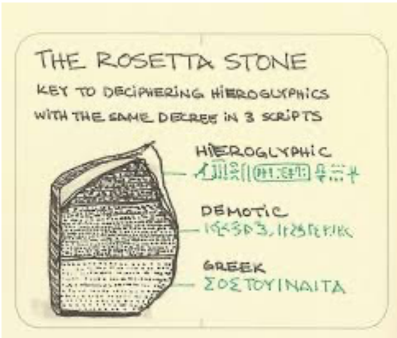
Babylonian Clay Tablet
YBC 7289

Good Approximation: To $\sqrt{2}$

$$1 + \frac{24}{60} + \frac{51}{60^2} + \frac{10}{60^3} \approx \sqrt{2}$$

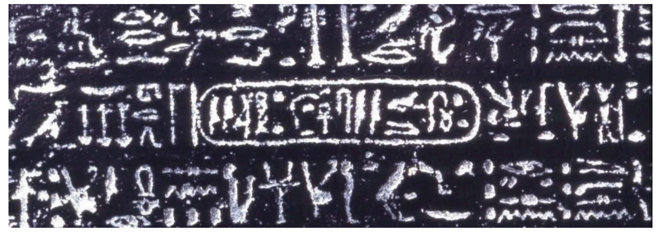
Google Street View: The Rosetta Stone

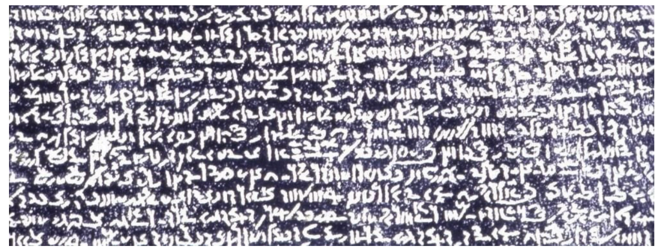
British Museum, London, United Kingdom — Google Arts & Culture

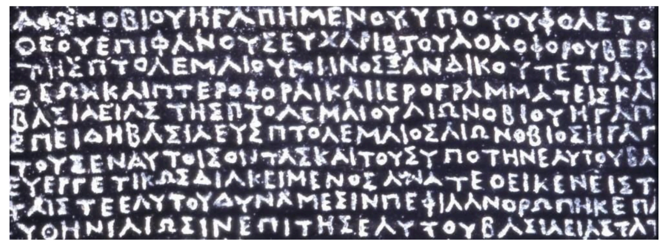


https://www.britishmuseum.org/blog/everything-you-ever-wanted-know-about-rosetta-stone

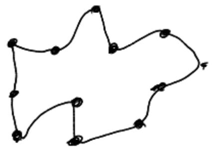
Found by Napoleon, 1798







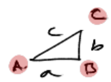
Egyptian 12-segment rope trick to lay off a right angle.



$P \Rightarrow Q$ statement

$Q \Rightarrow P$ converse (not always equiv. w/ $P \Rightarrow Q$)

$\sim Q \Rightarrow \sim P$ contrapositive



Pythagorean thm: If ΔABC is right angled then $a^2 + b^2 = c^2$

Converse: If $a^2 + b^2 = c^2$ then ΔABC is right angled

or more likely: "you will find it right", reflecting dogmatic/prescriptive nature of ancient Egyptian mathematics.

Lack of information on Chinese and Indian early mathematics is likely due to climate.

This course is a “mathematical masterpiece survey”. These masterpieces are theorems (with proofs). These proofs are much of why they are great. (That, coupled with the context of how hard the problem was at the time, or importance it later took).

While there were mathematical advances in Egypt, the concept of ‘proof’ did not arise until later - in Greece/Babylonia.

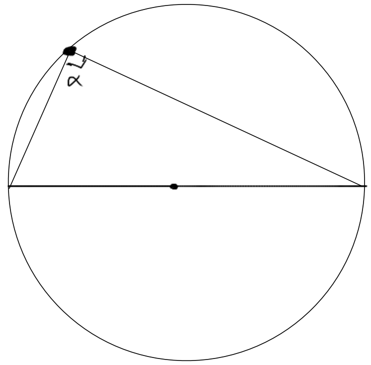
Thales of Miletus - 625 BC

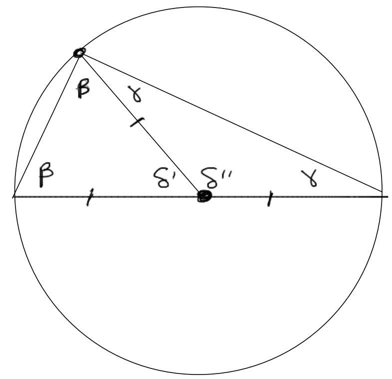
1. The First Mathematician
   a. Required proof , geometric intuition is not enough
   b. Oldest "proof" is his
2. Began the stereotype of the absent-minded genius
   a. Never married → what ruse did Thales use
   b. Was one "well" of a mathematician
3. "The most difficult thing to know in life is yourself."
4. Proved :
   a. Angle inscribed in a semi-circle is a right angle. e) vertical angles =
   b. Base angles of an isosceles triangle are equal.
   c. If two straight lines intersect, the opposite angles are equal.
   d. Angle sum of a triangle is two right angles.
5. Many of his theorems were perhaps known to the Egyptians, and conventional history seeks to look for some individual to whom the "miracle" can be ascribed - Thales is the natural candidate. He certainly contributed much to the rational organization of geometry (the deductive method).
6. The orderly development of theorems by rigorous proof was new and unique to Greek mathematics.

Thales

1. Visited Egypt, made indirect measurement of the height of the Great Pyramid by means of shadows.
2. Predicted solar eclipse in 585 BC, or did he?
3. Perhaps taught Pythagoras everything he knew.

Thale's Incribed Triangle Theorem : $\alpha = 90°$.
(inscribed on a diameter)





proof

$$\left.\begin{aligned} 2\beta + \delta' &= 180° \\ 2\gamma + \delta'' &= 180° \end{aligned}\right|$$

$$\delta' + \delta'' = 180$$

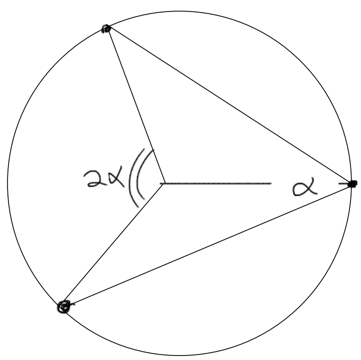
$$2\beta + 2\gamma + \underbrace{\delta' + \delta''}_{180} = 360$$

$$2(\beta+\gamma) = 180$$

$$\beta + \gamma = 90$$

Tools:

- Triangle Sum $= 180°$
- Supplementary Angles Sum $= 180°$
  (on a line)
- Isosceles Δ's have equal base angles



Star Trek lemma