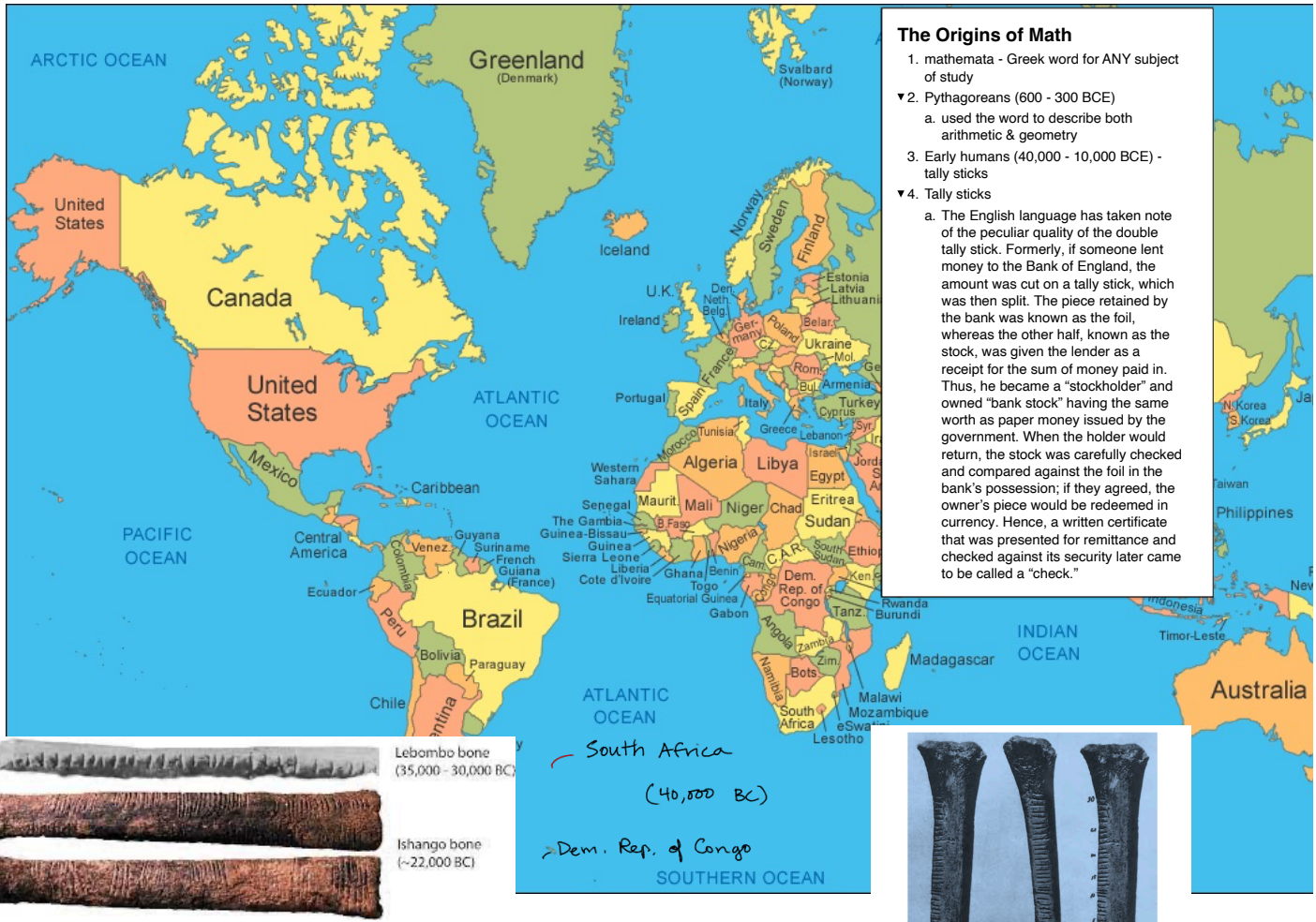
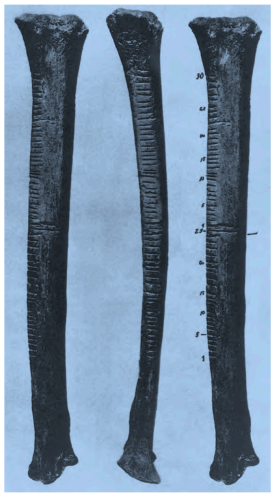
When (and where) did Math begin?



The Origins of Math

1. mathemata - Greek word for ANY subject of study
2. Pythagoreans (600 - 300 BCE)
   a. used the word to describe both arithmetic & geometry
3. Early humans (40,000 - 10,000 BCE) - tally sticks
4. Tally sticks
   a. The English language has taken note of the peculiar quality of the double tally stick. Formerly, if someone lent money to the Bank of England, the amount was cut on a tally stick, which was then split. The piece retained by the bank was known as the foil, whereas the other half, known as the stock, was given the lender as a receipt for the sum of money paid in. Thus, he became a "stockholder" and owned "bank stock" having the same worth as paper money issued by the government. When the holder would return, the stock was carefully checked and compared against the foil in the bank's possession; if they agreed, the owner's piece would be redeemed in currency. Hence, a written certificate that was presented for remittance and checked against its security later came to be called a "check."

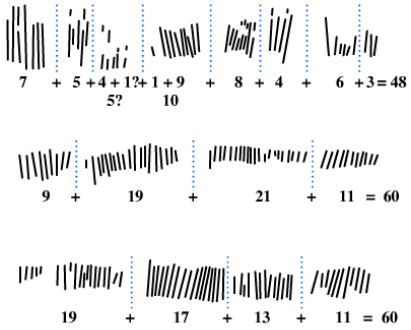
South Africa
(40,000 BC)
Dem. Rep. of Congo

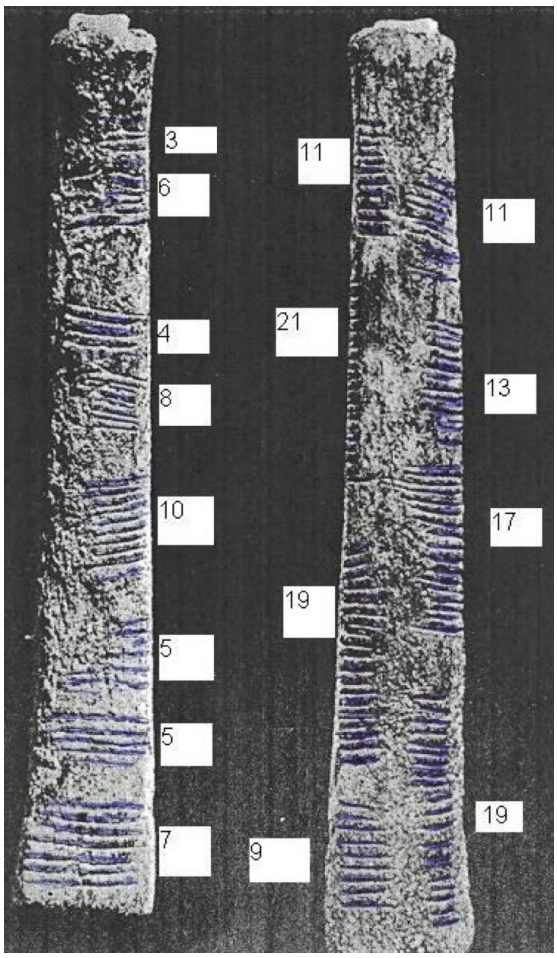


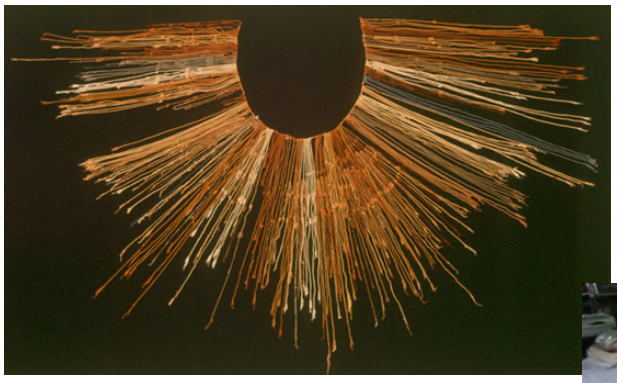
Three views of a Paleolithic wolfbone used for tallying. *(The Illustrated London News Picture Library.)*

Bone artifacts bearing incised markings (tallying sticks) date as far back as 30,000BC

- wolf bone (Czechosloakia (1937) is 7 inches long with 55 deep notes, all equal length
- they could tally hunts or kills, it's likely they tallied time
- Ishango, Egypt - headwaters of Nile - 17,500 BC (12,000 years before agrarian communities)
  3 columns:
  Sums of columns I and III are 60 indicating a reference to time







500 BC – Peru

Quipus

no writing in the Inca empire, so these
were a very important record of financial transactions

A *quipu* usually consisted of cotton or camelid fiber strings. The Inca people used them for collecting data and keeping records, monitoring tax obligations, properly collecting census records, calendrical information, and for military organization

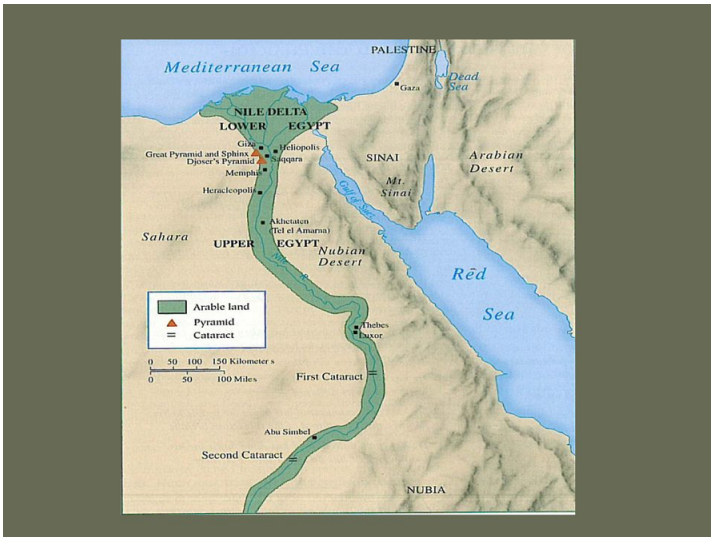
For example, if 4s represents four simple knots, 3L represents a long knot with three turns, E represents a figure-eight knot and X represents a space:

- The number 731 would be represented by 7s, 3s, E.
- The number 804 would be represented by 8s, X, 4L.
- The number 107 followed by the number 51 would be represented by 1s, X, 7L, 5s, E.

Much of what we know of Egypt comes from the “father of history” - Herodotus - whose job it was to “report what people say, not to believe it all”. He calls Egypt, “the gift of the Nile”.

3500 - 3100 BC, the self-sufficient agricultural communities along the Nile had gradually coalesced into two larger kindoms - North and South.

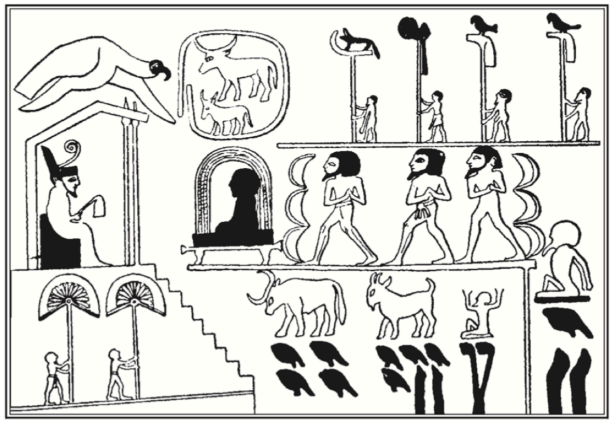
3100 BC these regions were united by military conquest from the south by Menes, the first of 32 dynasties that lasted almost 3000 years.

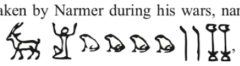
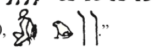


With Egypt's unification came the need for computation: a census, taxes, an army, etc.

One of the years of the Second Dynasty was named "Year of the Occurrence of the Numbering of all Large and Small Cattle of the North and South"

As early as 3500 BC, the Egyptians had a system that allowed them to count indefinitely.



This scene is taken from the great stone macehead of Narmer, which J. E. Quibell discovered at Hierakonpolis in 1898. There is a summary of the spoil taken by Narmer during his wars, namely "cows, 400,000,  goats, 1,422,000,  , and captives, 120,000,  ."

Scene reproduced from the stone macehead of Narmer, giving a summary of the spoil taken by him during his wars. *(From* The Dwellers on the Nile *by E. W. Budge, 1977, Dover Publications, N.Y.)*

"sacred signs" = hieroglyphics

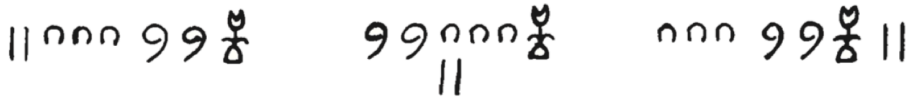
picture script, each character = concrete object

Egyptian hieroglyphic number symbols

1 10 100 1000 10,000 100,000 1,000,000 10,000,000

$$1 \cdot 100{,}000 + 4 \cdot 10{,}000 + 2 \cdot 1000 + 1 \cdot 100 + 3 \cdot 10 + 6 \cdot 1 = 142{,}136.$$

each expression below gives the same value

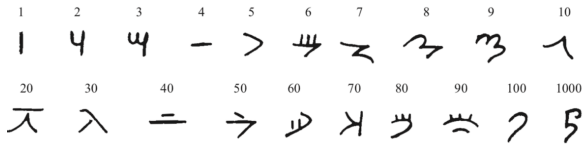


= 1232

Egyptian method was not a “positional numbering system”

The Egyptians wrote on papyrus (strips of a plant, they cut, "glued together" and dried) with brushes. These could be large and were rolled when not in use, and the dry air kept them from molding.

Hieratic script evolved, which was "ciphered", and eventually "demotic" or popular script. - row upon row of commas and dashes distinguish numbers

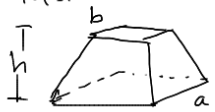


Moscow Math Papyrus : 18' long
1800 BC

1 α	10 ι	100 ρ
2 β	20 κ	200 σ
3 γ	30 λ	300 τ
4 δ	40 μ	400 υ
5 ε	50 ν	500 ϕ
6 $\digamma$	60 ξ	600 χ
7 ζ	70 o	700 ψ
8 η	80 π	800 ω
9 θ	90 $\qoppa$	900 $\sampi$

- 1878 Thieves found it, sold it to Egyptologist; from there to Mosow – 1912, only in 1930 was it translated.

Inside. $V = \frac{1}{3}h(a^2 + ab + b^2)$



h = actual height

Frustum of Pyramid

- 500 BC, Heron of Alexandria

slant height $h = \sqrt{c^2 - 2\left(\frac{a-b}{2}\right)^2}$

c = actual height

one ex: $a = 28, b = 4, c = 15$

gives a negative radicand

— a complex #

$\sqrt{-168} \xrightarrow{\text{Heron}} \sqrt{168}$