*Computing Before Computing

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- Software Developer
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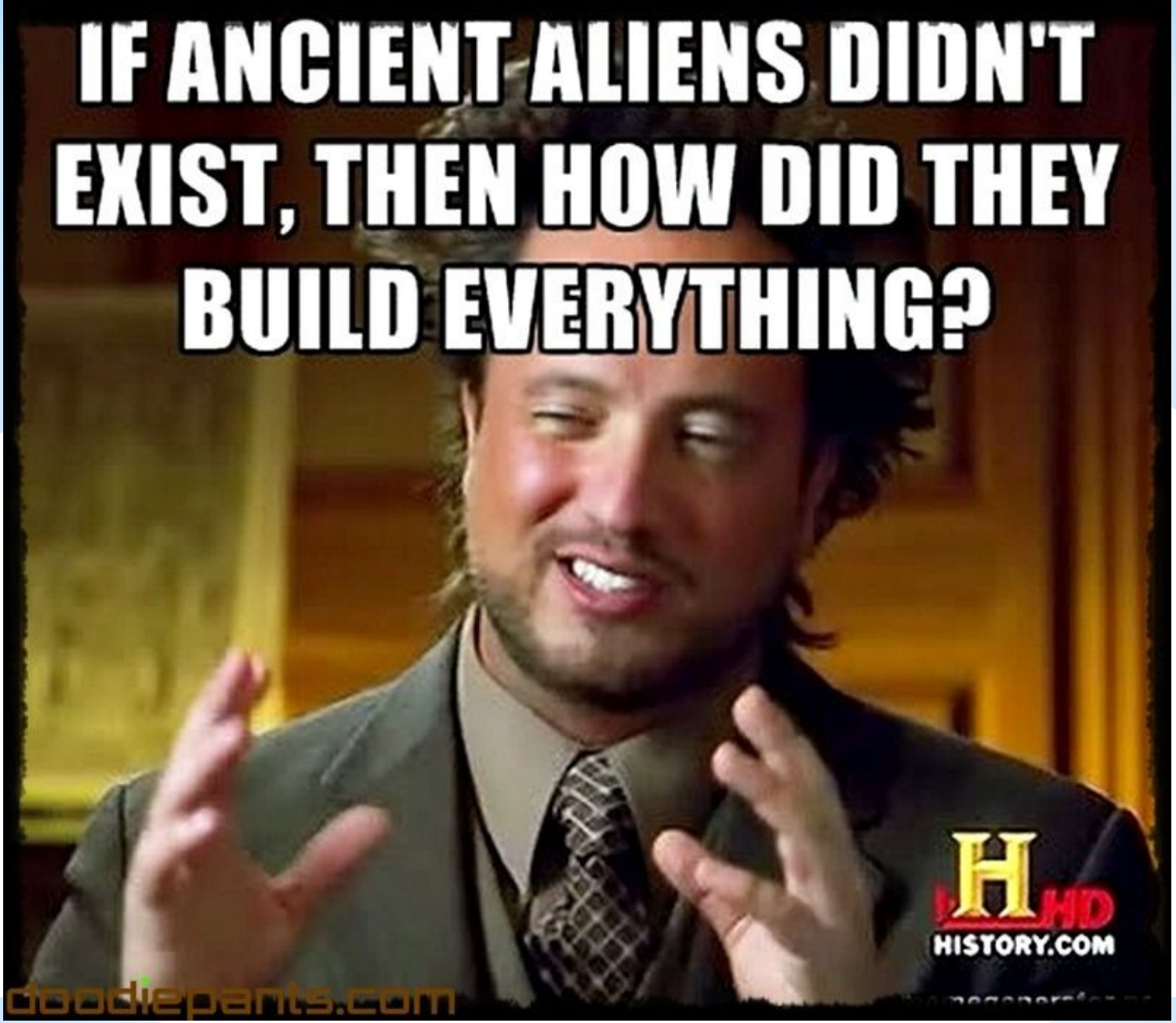
You are what you Do

A tool and his project is soon started

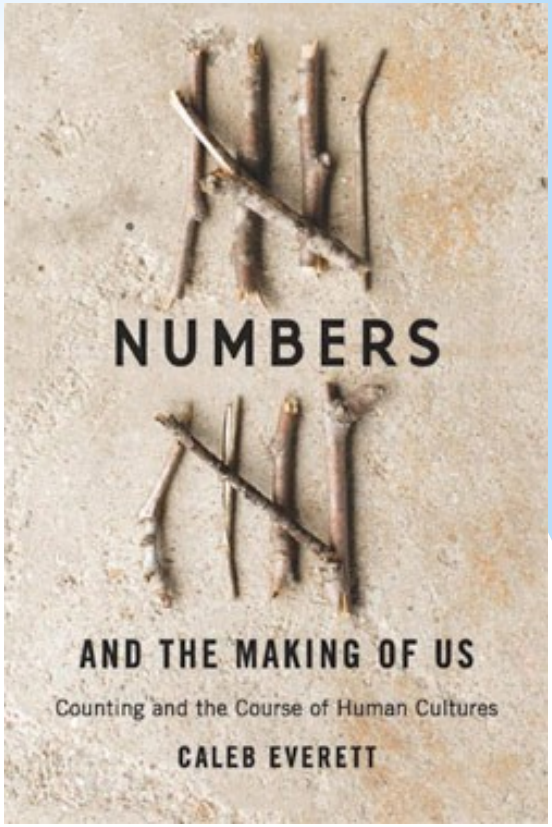
- Primer on the History of Numbers
- Paleolithic tally sticks
- The ancient Egyptian's calculations
- The Sumerians – Abacus
- The Greeks Antikythera mechanism
- The Chinese Abacus, and
- Europeans mechanical calculators

- **A brief survey of computational technology**


IF ANCIENT ALIENS DIDN'T EXIST, THEN HOW DID THEY BUILD EVERYTHING?
HISTORY.COM
doodiepants.com

The unnatural nature of numbers

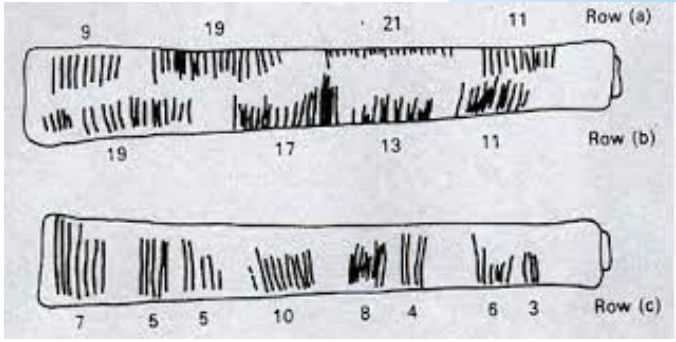
- Caleb Everett discovered the Pirahã (amazons) had no words for quantities
- Couldn't distinguish between quantities greater than three
- Mathematical concepts aren't wired into the human condition.
- It's acquired through cultural and linguistic transmission



Are we wired for Mathematics?

The Paleolithic

- Ishango Bone tool Upper Paleolithic era (18,000 – 20,000) yrs old
- Early tally stick or mathematical tool?
- Groupings of notches suggest knowledge that goes beyond counting



I’m counting on you!

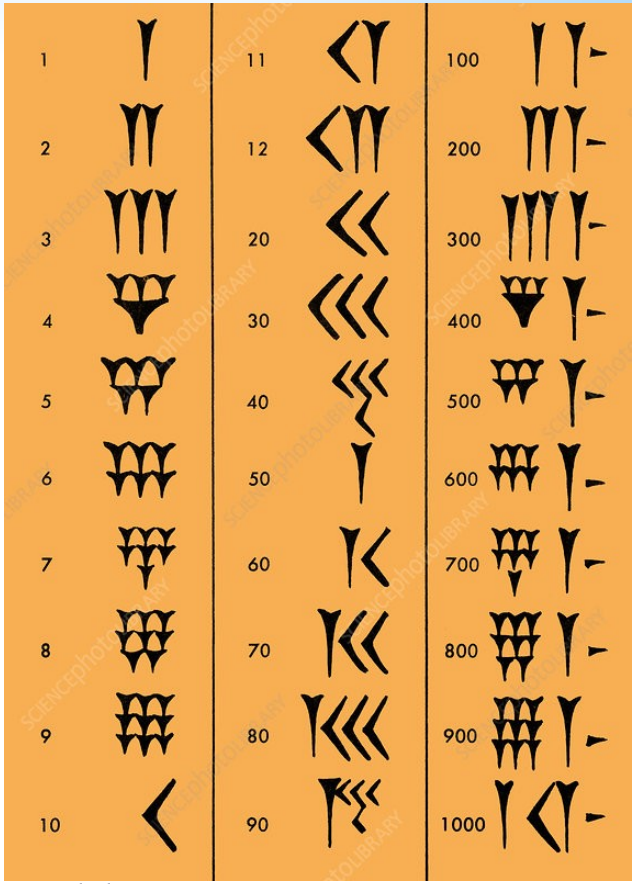
It’s all about the Benjamins

- Numbers, & counting, began about 4,000 BC in Sumeria
- As cities grew, we needed a way to organize, track and trade livestock, crops, and goods
- Numbers allow trade to be done more precisely
- Enable new kinds of trade & bigger structures
- More pressure to invent better mathematics and tools

How Numbers Impact Us

The Sumerians

- Clay cones sealed in a clay pouch with stamps outside to represent the amount
- These were replaced by a token.
- Each token represented something physical
- When you traded a token was removed
- Adding & subtraction were invented
- Used a base 60 numbering system
- This was replaced with marks on a clay tablet
- To prevent theft officials kept track of and marked them with an official seal
- Was writing invented to augment the tallies?



Come Mr. Tallyman and tally me banana

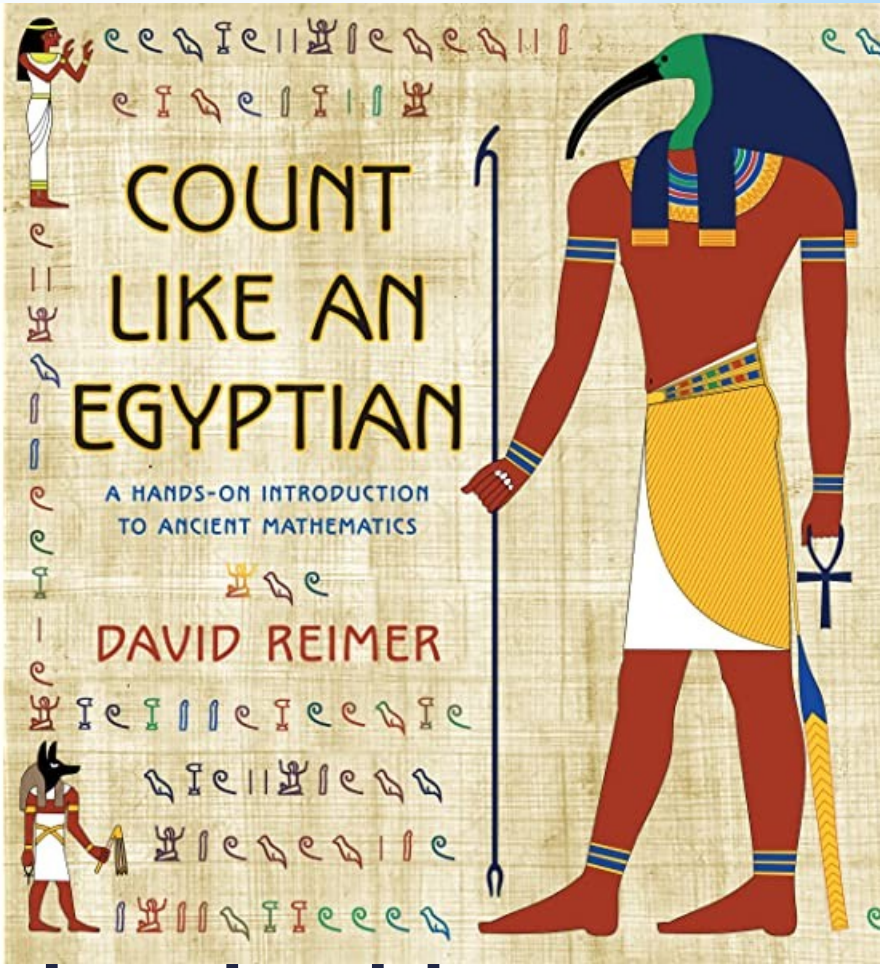
The Sumerian -Abacus

- Sumerian abacus appeared between 2700 and 2300 BC
- A simple stone tablet is divided into 5 columns numbered 1s, 10s, the 60s, 600s, and 3600s

The 60s were very good for me!

The Egyptians

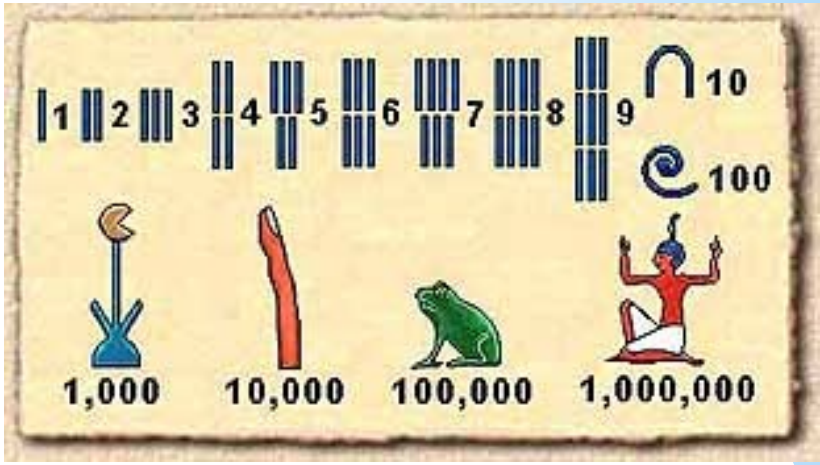
- Around 3,000 B.C. Egypt transforme numbers into a unit of measuring
- Invented the cubit – length of a man's forearm from elbow to fingertips
- With precise units of measurement Egyptians can build pyramids, temples, canals, and obelisks with great accuracy
- Hieroglyphs carved in stone don't require symbols that could be written quickly



I've got your number buddy

The Egyptians

- Invented the paper & pen
- Flattened sheets of dried papyrus & tip of a reed
- Developed and solved quadratic equations – Berlin Papyrus fragment
- Solved first-degree algebraic equations - Rhind Mathematical Papyrus

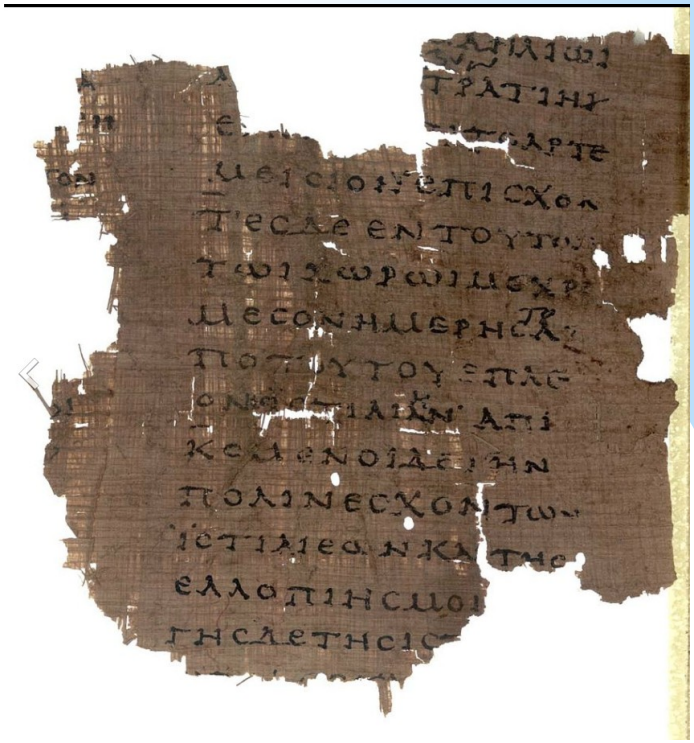


- Egyptian like the Roman numbers wasn't well suited for calculations
- Trade required multiplication, division, and fractions
- The Egyptians were concerned with practical arithmetic

You thought math was hard, try using hieroglyphs

Egyptian Abacus

- The simplest form of calculating device was a kind of table or tablet on which calculations were written in sand or dust
- Egyptian abacus manipulates the pebbles from right to left, the opposite of Greek left-to-right – Greek historian Herodotus
- Archaeologists have found ancient disks of various sizes that are thought to have been used as counters



Try counting on your fingers - backwards

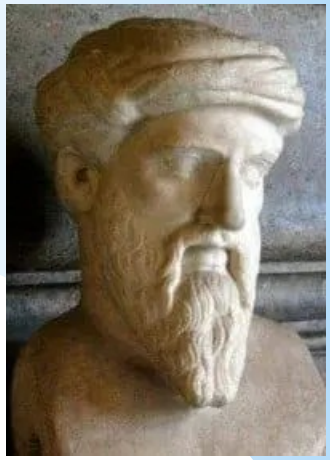
The Greeks - Pythagoras

- Pythagoras studied in Egypt and established a school of Mathematics
- Introduced Greece to mathematical concepts already prevalent in Egypt
- One of the first theoretical mathematicians
- Produced the Pythagorean theorem
- Came up with odd and even numbers
- To him odd numbers were male and evens were female
- Controversial figure -established a school at Croton in southern Italy around 530 BCE which was the nucleus of a bizarre cult

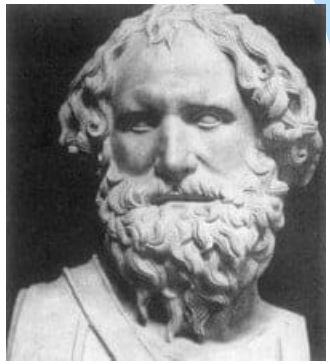
Join our cult - we've got math!

The Greeks - Archimedes

- Archimedes screw, a circular inclined plane (a screw) inside a tube that pumps water from one level to a higher level
- Invented a method of determining the volume of an object with an irregular shape
- Invented a method of determining the volume of an object with an irregular shape
- The answer came to him in his tub and he ran naked into the streets yelling “Eureka!”



Pythagoras



Archimedes

Get attached to an inclined plane, wrapped helically around an axis

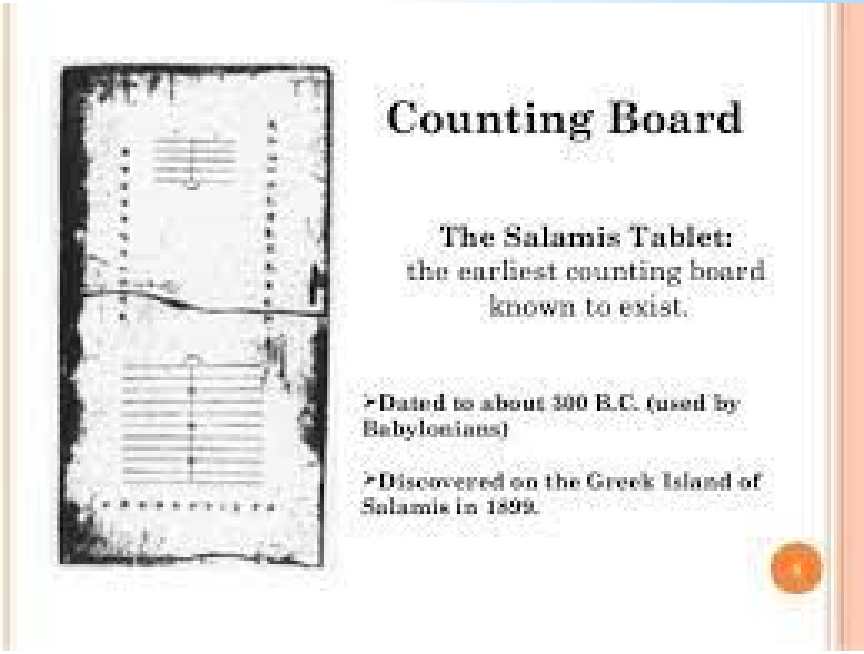
The Greeks - Antikythera Mechanism

- An ancient astronomical calculator
- Used ground-breaking technology to make astronomical predictions
- Tracked the paths of the Sun, Moon, and 5 visible planets with impressive accuracy
- Size of a mantel clock in a wooden case, with a large circular face and rotating hands
- Nothing has been discovered like this for a thousand years
- Only a third of the original survives

You are my sun, moon & planets

The Greeks - Salamis Tablet

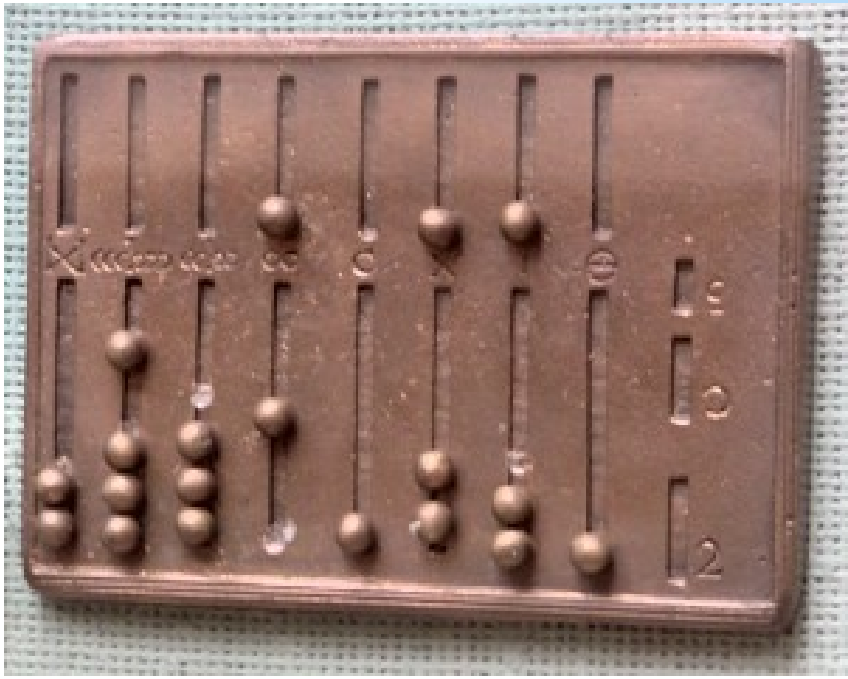
- Tablet found on Greek island Salamis dating to 300 B.C.E – oldest counting board
- Made of marble, pre-set with small counters for mathematical calculations
- Used in Achaemenid Persia, Etruscans, Ancient Rome, and western Christian world



Let me crunch some marble and I will get back to you

The Romans - Abacus

- Roman wished to settle accounts, he would say 'vocare aliquem ad calculos' - 'to call them to the pebbles.'
- Each of the seven decimal digits has four beads in the lower slot and one bead in the upper slot; functioning exactly like the Soroban
- Romans would use their abaci for engineering calculations
- Complicated calculations were always done with the abacus."



You try dividing with Roman numerals!

The Indians

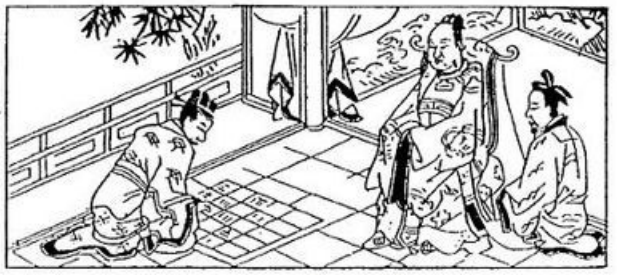
- In 500 AD The Indians invented an entirely new number: zero
- The ability to make numbers infinitely large or infinitely small.
- Created a different symbol for every number from one to nine (Arabic numerals)
- Leonardo Pisano Bigollo, (Fibonacci) introduced to Arabic numbers to Europe
- Merchant class found it could use it to quickly, easily, and more precisely calculate interest on their goods and properties

1	2	3	4	5	6	7	8	9

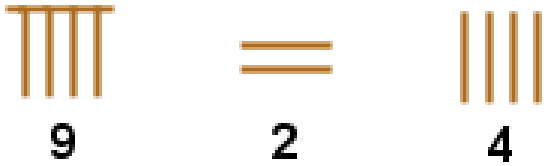
You've got nothing, nada, zero

The Chinese

- 2nd millennium BCE used small bamboo rods arranged to represent the numbers 1 to 9, which were then placed in columns representing units



Example: 924



We're the first but who's counting

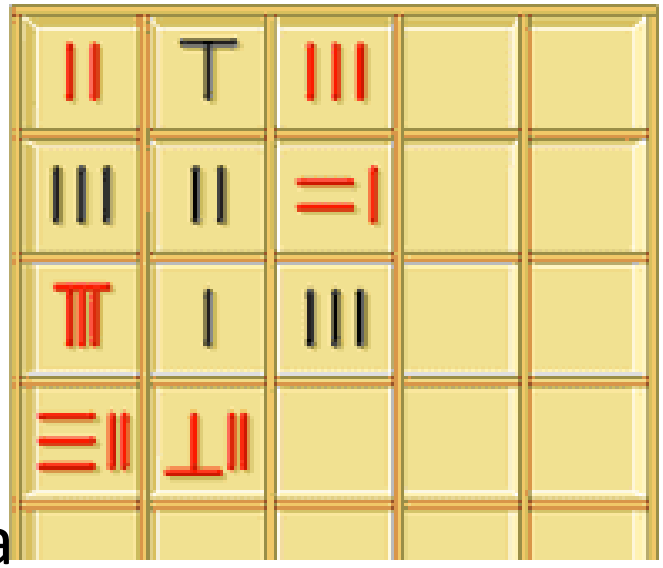
The Abacus

- Japanese soroban abacus
- It's derived from the ancient Chinese suanpan
- Imported to Japan 14th century
- Suanpan and soroban are still used
- Fast and accurate computer
- (Soroban) operator beat a skilled electric calculator operator in a contest in Tokyo on Nov 12, 1946

Didn't John Henry try this with a steam hammer?

The Chinese - The Counting Board

- A good example of a technological invention's influence on science
- Used by 400 BCE, made of polished wood and had rulings that formed a grid of square cells



Columns were used for equations, from right to left:

$3x + 21y - 3z = 0$
$-6x - 2y - z = 62$
$2x - 3y + 8z = 32$

Negative
Positive

The board doesn't lie?

The Europeans

- In 1679. German mathematician Gottfried Liebnitz invented a system of counting that used only ones and zeros
- Liebnitz designed but never built a machine that would count in binary

One is a lonely number

A Timeline

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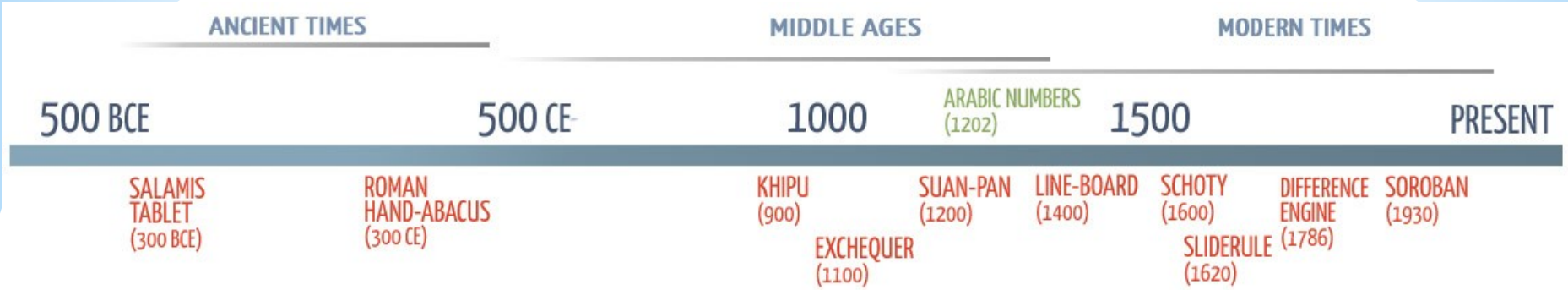
ANCIENT TIMES
MIDDLE AGES
MODERN TIMES
500 BCE
500 CE
1000
ARABIC NUMBERS (1202)
1500
PRESENT
SALAMIS TABLET (300 BCE)
ROMAN HAND-ABACUS (300 CE)
KHIPU (900)
EXCHEQUER (1100)
SUAN-PAN (1200)
LINE-BOARD (1400)
SCHOTY (1600)
SLIDERULE (1620)
DIFFERENCE ENGINE (1786)
SOROBAN (1930)

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