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## Tallies and Tablets - The Origins of Mathematics

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Have you ever wondered what a teraflop is? No, it is not a clumsy prehistoric fish. A teraflop is a unit that measures the speed of computer calculations. One teraflop is 1 trillion calculations per second! These incredible electronic calculations originated with the idea of numbers and counting. Most of us take math for granted, but numbers and counting have taken thousands of years to develop. So how did it all begin?



Tens of thousands of years ago, our ancestors found their food by hunting for meat and gathering wild plants. Survival was a constant struggle. Little did they realize that some mathematics could vastly improve their lives. For example, if they knew when certain berries were ripe, they could save themselves a lot of wandering time by only going to the berry thickets at precisely the right moment. The hunters and gatherers of ancient times needed something constant in their environment to help them track time.

Early peoples observed the geometry in nature, the cycles of the seasons, and the splendor of the Milky Way. Our ancestors noticed the moon's pattern of becoming full, then slender, then full again in a recurring thirty-day cycle. This cycle gave them a key to solving the dilemma of tracking time. They began to cut notches in a tree or a stick to keep track of the days and of lunar cycles. Harvesting food became much more efficient with this new system.

The idea of keeping track of the lunar cycle sounds simple, but it was a momentous event in the evolution of mathematics. Our ancestors were keeping a *tally* for the first time, and they probably began to use this form of counting in other areas of their lives. The earliest known tallies were carvings in bones dated approximately 15,000 years ago, which were discovered in the area now known as the Middle East. Putting pebbles or shells in a pile was another way of keeping a tally. Keeping track of items by using simple marks or objects was still a long way off from the invention of numerals, but it was a big step forward.

Another way that early people kept track of things was by using "body counting." Different parts of the body represented different amounts of things. For many thousands of years, people counted using their ten fingers, and some tribes took this idea even further. The Paiela tribe who lived in the highlands of Papua New Guinea counted by pointing to different parts of their bodies to represent different numbers. For example, their little fingers represented the number "one." Other fingers, wrists, elbows, shoulders, ears, and eyes all represented different numbers up to twenty. Body counting worked fine as long as there was no need for large numbers.

When our ancestors became farmers, they needed to keep track of larger amounts of things. Farming probably started when the hunters and gatherers visited a campsite where they had lived during the previous season and noticed grain growing from seeds they had accidentally dropped on the ground. They learned to save seeds and sow crops rather than gather wild plants. They also learned to keep sheep, goats, and cows in pens and slaughter

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them rather than hunt for wild animals. Life became easier, and villages formed since no one had to wander around to find food to survive. A better system of counting evolved because the men who became shepherds had to count their animals, and the men who became farmers had to keep track of their harvest.

Sometime between five thousand and ten thousand years ago, farmers began counting in a concrete way by using small tokens of different sizes and shapes. Different shapes represented different items. For example, a round disk represented a sheep; ten disks meant ten sheep. An egg-shaped token represented a jar of oil. Some cultures, like the Incas of Peru, kept tallies by tying knots in cords called *quipus* to keep track of sheaves of grain or herds of animals. This was the next step in the development of mathematics because people were counting in a concrete way using objects.

The Sumerians were the first ones to use a system of written numbers. They lived in the area now known as Iraq around 3000 B.C. The Sumerians used clay tablets and pressed different shaped marks into them to represent different amounts. The clay was then baked in a kiln or dried in the sun to transform it into a hard tablet. The Sumerians also developed the first system of writing, which they also did on clay tablets using a reed marker. By this time, cities were larger, and people began to trade more. Traders needed written numbers to keep track of their goods and to keep accurate accounts.

The Sumerians came up with symbols to represent numbers, and they developed two different counting systems. One system was a decimal system based on the unit 10. The other system was based on units of 60, which is why we divide an hour into 60 minutes, and why we divide a minute into 60 seconds. The Sumerian system was amazing, but it had one flaw - it had no zero. They just left a space when there was no value, which led to problems in reading numbers. For example, if you had the number 204, and left out the zero, it could be mistaken for 24, which is a different value. It took a little longer for mathematicians to figure out that they needed a symbol to represent "nothing," so the concept of zero came later in the history of mathematics.

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## Questions

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- \_\_\_\_\_ 1. What is a teraflop?
- A. a clumsy, prehistoric fish
  - B. an archaeological artifact
  - C. a unit of measurement of the speed of computer calculations
  - D. the missing link in man's evolution
- \_\_\_\_\_ 2. What does the word "lunar" mean in paragraph 3?
- A. crazy
  - B. moon
  - C. musical
  - D. sun

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- \_\_\_\_\_ 3. Which of the following is NOT true?
- A. A written system of numbers was developed about 5000 years ago (3000 B.C.)
  - B. People began using tallies about 15,000 years ago.
  - C. A lunar cycle is six months long.
  - D. Sometimes pebbles were used to keep a tally.
- \_\_\_\_\_ 4. How long is a lunar cycle?
- A. thousands of years
  - B. the article does not say
  - C. 3 days
  - D. 30 days
- \_\_\_\_\_ 5. Who were the first to use a system of written numbers?
- A. the Incas
  - B. the Sumerians
  - C. the Egyptians
  - D. the Paielas
- \_\_\_\_\_ 6. Where did the Sumerians live?
- A. Africa
  - B. South America
  - C. Iraq
  - D. Iran
- \_\_\_\_\_ 7. What is missing in the Sumerian system of numbers?
- A. 60
  - B. 10
  - C. 0
  - D. 1
- \_\_\_\_\_ 8. What are quipas?
- A. ancient games
  - B. ancient jokes
  - C. ancient numerals
  - D. knots in cords used for counting

