MATHEMATICS IN ANCIENT EGYPT

The Birth Of Mathematics

There are two important views that mathematics originated in Ancient Egypt.

One of them belongs to the famous Greek historian Herodotus and the other one belongs to the Aristotle. The Greek historian Herodotus made the following statements after his journey to Egypt: "Egypt is a gift of the Nile River and mathematics was born in Egypt.". Herodotus thought that the annual flooding of the Nile directed people to recalculate the area of fields and draw boundaries which led to the birth of geometry.

According to Aristotle, mathematics was also born in Ancient Egypt but Aristotle offers a different and more interesting reason than Herodotus' theory. According to Aristotle, mathematics was born not out of the need to measure the land caused by the Nile floods but out of the boredom of the clergy living in Egypt. Since the only intellectual class in Egypt at that time was the priestly class, he claims that the clergy spent too much time on intellectual pursuits and invented arithmetic and mathematics.

Although the certainty of these two views carried from the past to the present has not been proven, it is thought that both views may be correct, but it is also useful to remember this: At that time, mathematics was more focused on satisfying needs. These needs were things like determining the time, accounting works and construction, heritage distribution. Mathematics was an important driving force for progress in the ancient world. Without it, a society could not collect taxes, keep crop records or design architectural marvels such as the pyramids. The Egyptians used geometry, algebra and arithmetic to accurately calculate things like land measurements, estimating crop yields and taxation.

There are very few documents about Ancient Egyptian mathematics. There are two main reasons for this situation:

- Ancient Egyptians wrote on papyrus. Egyptian papyrus was produced from reeds. It would be a miracle for such a material to last long.

- The destruction of the written works in the libraries of Alexandria as a result of fires.

We learn about Ancient Egyptian mathematics from two papyrus that have been preserved from the past. These are the Ahmes (Rhind) and Moscow Papyrus.

Ahmes (Rhind) Papyrus

6 meters long and 35 centimeters wide, this papyrus is thought to have been written in 1850 BC. Its purpose is to teach mathematics. In the introduction, there are a few exercises involving operations with fractional numbers followed by 87 questions with complete solutions. These questions include arithmetic operations such as interest calculation and finding the areas of some geometric shapes that can be encountered in daily life.

For example in the 24th problem, there were simple questions related to an equation with one unknown such as "What number gives 19 when 1/7th of that number is added to itself?". The modern representation of this problem is "x + x/7=19". The Egyptians tried to find the solution to this problem by trial and error.

Moscow Papyrus

The Moscow papyrus, written in 1600 BC, contains 25 questions. Although these questions have almost the same level of difficulty as in the Ahmes papyrus, 2 questions are very difficult and different. Because, considering the level of mathematical knowledge of that period, it is challenging to ask these questions. The first question was about how to find the volume of a truncated pyramid. It seems likely that the questions about the pyramid were asked in order to create the formal details of the pyramid-shaped mausoleums built at that time. The other question seems to be a little more difficult than the first one. It was about how to calculate the volume of the divided sphere piece formed by any line cutting a sphere. Both of these questions were solved correctly and these questions are considered to be the peak of the Egyptian mathematics.

Ancient Egypt Number System

It is widely accepted that Egypt was the first civilization to develop a number system. The Ancient Egyptian number system is based on base 10. The spelling and use of numbers in the Egypt number system are similar to the Roman numerals. Although the shapes in this number system developed by the Ancient Egyptians are very interesting, they are very difficult to use. There was a problem with this number system. Numbers more than 1 million could not be easily expressed and for these numbers, the symbol "confused man" was used. In other words, it was impossible to understand the numbers higher than 1 million. In ancient Egypt, numbers and numerals were formed by the aligning of certain symbols (shapes). All numbers were expressed by the combination of 7 different shapes.
For example, they used a vertical line from top to bottom for 1, a horseshoe shape for 10 and a hook sign for 100. It is necessary to use 9 different symbols to express the number 90, 9 different symbols to express the number 90, 18 different symbols for 99 and 27 different symbols for the number 999. So that is a difficult alphabet to express numbers.

Basic math operations

The Ancient Egyptians often made calculations by hand. For example, if they wanted to calculate the sum of 3 cats and 4 dogs, they would represent the symbol for 3 cats with triangles and the symbol for 4 dogs with squares. By placing these symbols side by side, the sum could be found.

A similar method was used for subtraction operation. For example, if they wanted to subtract 2 crocodiles from 7 crocodiles, they would represent the symbol for 7 crocodiles with seven triangles and the symbol for 2 crocodiles with two triangles. The difference could be found by placing these symbols side by side.

The Ancient Egyptians used an interesting way to multiply two numbers. The algorithm draws on the binary system: multiplication by 2. They used addition to get the answer to a multiplication problem. This method is still used in many rural communities in Russia, Ethiopia and the Near East. The term that we use with Egyptian multiplication is called “doubling”. You take one number and either multiply it by 2 or you add it to itself. This is done repeatedly until you get the other number.

For division, the Ancient Egyptians often used multiplication. For example, when they wanted to divide 28 by 4, they would calculate how many times 4 is a multiple of 28.

Geometry

The Ancient Egyptians used geometry to build large structures such as pyramids and temples. These structures had geometric shapes, such as four-sided pyramids and rectangular prisms. Fort that reason, the Ancient Egyptians' mastery of geometry was important for the construction of these structures. One of the most important geometric principles used by the ancient Egyptians for the construction of pyramids was the principle of similarity. Pyramids consisted of a combination of triangles and rectangles. The base of the pyramids was usually in the shape of a square or rectangle and the proportions between the side lengths of these shapes were proportional to the height of the pyramid. Therefore, the Egyptians paid attention to the side lengths and proportions of the base to calculate the height of the pyramids. They were also aware long before Pythagoras, of the rule that a triangle with sides 3, 4 and 5 units yields a perfect angle and Egyptian builders used ropes knotted at intervals of 3, 4 and 5 units in order to ensure exact right angles for their stonework .In fact, the 3-4-5 triangle is called “Egyptian Triangle”. The Egyptians also used geometric calculations during the construction of temples. Temples were usually rectangular prisms with walls made up of surfaces connected at right angles. They used geometry to determine the junction points of the walls at right angles. The Ancient Egyptians were also very good at calculating the area and volume of geometric shapes. For example, to calculate the area of a triangle, they multiplied the height of a triangle by the length of its base and divided the result by two. To calculate the area of rectangle, they multiplied the length and width.

Calendar

The Ancient Egyptians noticed an interesting “coincidence” while observing nature. Every year, when the Sirius Star reaches the heliacal rising, on 15 July, the Nile River overflows. Thus, the Egyptians created their first calendar by establishing a connection between nature and the stars. Their calendar is the solar calendar. In this calendar, there are 12 months of 30 days each and there are extra 5 days as holidays. A day is calculated as 24 hours. Daylight hours are usually calculated with the help of sundials. In cloudy weather and at night when sundials did not work, water clocks were used to measure the time. The ancient Egyptians did not base their calendar on lunar cycles because the movements of the moon were not regular and did not correspond to annual periods. Instead, by basing their calendar on the movements of the sun, they were able to measure annual periods more accurately. The calendar of the ancient Egyptians was based on the assumption that the year had 365 days. It consisted of 12 months and each month was divided into 3 weeks of 30 days. Because this calendrical year was a quarter of a day shorter than the actual solar year, the Egyptian calendar lost one day every four years relative to the Gregorian calendar. The calendars of the ancient Egyptians were based on astronomical observations. Each year at sunset, the positions of points marked by a particular star were recorded. These observations were used to ensure that the calendar was adjusted correctly.

Conclusion

The Ancient Egyptians were masters of mathematics and developed some of the most sophisticated techniques of their time to meet their needs. Their mathematical knowledge was very advanced that Greek mathematicians like Pythagoras and Thales traveled to Egypt in order to learn their mathematical methods. Unlike modern mathematicians, the Egyptians did not focus on discovering axioms or establishing relationships between sets of numbers. Instead, they relied on brute force and trial-error methods to solve problems. Interestingly, many of the methods we use today still rely on these same principles. For example, when a supercomputer is used to solve complex equations or calculate prime numbers, it performs a massive number of calculations in seconds relying on the same fundamental principles that the Egyptians used thousands of years ago. From this point, the legacy of Egyptian mathematics continues to influence modern mathematical thinking and problem-solving techniques.

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