Egyptian Mathematics

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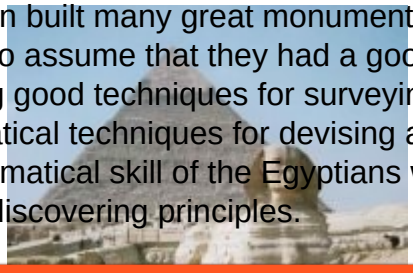
History of Mathematics

Alongside the Babylonians and Indians, the Egyptians are largely responsible for the shape of mathematics as we know it. Their knowledge and techniques passed on to the Greeks, helping the Hellenes to develop their great store of mathematical knowledge. Sadly, what we know about Egyptian mathematics is scanty and incomplete.



The Egyptian civilization built many great monuments over a period spanning thousands of years, and it is logical to assume that they had a good knowledge of applied mathematics, based upon developing good techniques for surveying and building. They also used sophisticated mathematical techniques for devising a calendar, for administration, and for accounting. The mathematical skill of the Egyptians was focused upon solving real world problems, rather than discovering principles.

The Roots of Egyptian Mathematics: Egyptian Surveying

The Egyptians never explored the theoretical side of mathematics in the same was as the Greeks, but they knew the basic principles. Through trial and error, they developed mathematical techniques that would help them to function as a society, and devise their great building works. Even Plato and Aristotle admitted that the Greeks owed much to the Egyptians for their previous work in arithmetic, geometry, and astronomy.

According to Herodotus, the mathematics of the Egyptians had its roots in surveying. The Pharaoh of Egypt gave each Egyptian a plot of land, of equal size, and taxed them upon this. However, the annual Nile floods could quite easily wash away land, so the king dispatched surveyors to see by how much a tenant's land had been reduced and lowered the taxes accordingly. In addition, the Nile floods made establishing boundary markers impossible, because the inundations would soon wash them away, so the surveyors were often called upon to mediate in any boundary disputes.

Egyptian Numbers and Trial and Error

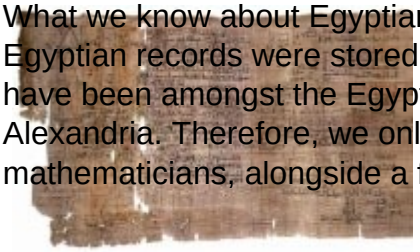
To support the idea that the Egyptians were fine mathematicians, a number of papyruses proved to be a guide to solving problems in arithmetic and geometry. This papyrus, alongside hieroglyphics, showed that the Egyptians used a decimal system of numbers, although it was not positional like our modern system, which meant that they did not need a symbol for zero, much like the Roman system of numbers. The Egyptians could add and subtract using this system of numbers, but division and multiplication were time consuming and difficult and relied upon doubling or halving, as with a computer binary system.

The Egyptians used trial and error techniques to arrive at solutions to problems, and had little interest in looking for formulae or complex interrelationships between sets of numbers. The formulas that the Egyptians developed gave them ways to estimate the areas and volumes of shapes and solids, which, whilst not perfectly accurate, were a close enough approximation for their purposes.

The Egyptian mathematicians understood a little algebra and were capable of solving linear equations, and could solve simple quadratic equations by using a series of guesses to find the closest answer, a brute force method that was used for many centuries afterwards.

Complex Egyptian Mathematics: Volumes and Fractions

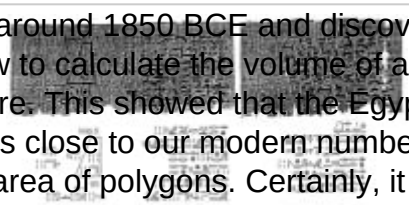
What we know about Egyptian mathematics is scanty and incomplete. Sadly, most of the Egyptian records were stored on papyrus, which, apart from the problem of degradation, may have been amongst the Egyptian mathematical texts burned during the fire at the Library of Alexandria. Therefore, we only have a few manuscripts to reveal the skill of the Egyptian mathematicians, alongside a few hieroglyphic records and Greek sources.



Rhind Mathematical Papyrus Thebes: End of the Second Intermediate Period Acquired by the Scottish lawyer A.H. Rhind during his sojourn in Thebes in the 1850s. Paul James Cowie, (Creative Common)

The Rhind papyrus discovered by Henry Rhind, in the 19th century, dates from 1650 BCE and is filled with problems and solutions, also including a section on fractions. The Egyptians preferred to reduce all fractions to unit fractions, such as 1/4, 1/2 and 1/8, rather than 2/5 or 7/16. All of these complex fractions were described as sums of unit fractions so, for example, 3/4 was written as 1/2+1/4, and 4/5 as 1/2+1/4+1/20. This seems a little unwieldy but is actually straightforward to use once you are used to it.

The Moscow papyrus, also dating from around 1850 BCE and discovered by Golonischev, contained further problems showing how to calculate the volume of a truncated pyramid and work out the surface area of half a sphere. This showed that the Egyptians used a value of 256/81 for Pi which, at a figure of 3.16, is close to our modern number, and was arrived at through brute force and calculating the area of polygons. Certainly, it was accurate enough for most practical uses.



Moskow papyrus by Quatrostein (Creative Commons)

These techniques were used in the building of the pyramids and other monuments, and the Egyptians devised a measuring system over the centuries. Their standard of measurement was the cubit, around 52.3 cm long, and they used rulers and knotted ropes to make measurements.

The Legacy of the Egyptian Mathematicians: Supercomputers

In terms of using mathematics everyday, the Egyptians were masters and devised some sophisticated techniques. Their mathematicians were so skilled that great Greek mathematicians such as Thales and Pythagoras learned techniques in Egypt.

The Egyptians did not see any need to discover axioms or find relationships between sets of numbers, and were happy to use brute force and trial and error methods to solve problems. In many ways, we still use these methods today: When a supercomputer is used to discover prime numbers to calculate a few more decimal places for Pi, it uses force to perform huge numbers of calculations every second.
