ARCHAEOLOGY

The Egyptian Schoolboy's Arithmetic

Mathematical Papyrus Shows that Pupils Were Taught To Multiply and Divide in Classes Held 3000 Years Ago

By EMILY DAVIS

DIVIDE 100 loaves among 10 men, including a boatman, a foreman, and a doorkeeper who receive double portions: What is the share of each?

No, this is not one of Junior's homework problems. It was not taken from the latest edition of the seventh-grade arithmetic book. It is a problem out of a book on mathematics written by an Egyptian scribe named Ahmose, who lived 1650 B.C.

As far back as that, schoolboys were struggling to divide rations among laborers, and the inquisitors who made up the problems were sugar-coating the pill by concocting little stories about the figures. Instead of dividing rations among so many men, the school boy was to think of the men as real people—a boatman, a foreman, and a doorkeeper. As far back as 1650 B.C., Egyptian schoolboys were learning how to measure the area of a triangle. Of course triangles were especially important things to understand in the land of the pyramids. Same old arithmetic, same old geometry!

How the arithmetic and geometry of the Egyptians resemble modern mathematics and how they differ in some other respects, are known today chiefly from one book. This is the book from which the problem about the loaves and the laborers was taken. The book is known today as the Rhind Mathematical Papyrus.

There are some other scraps of Egyptian books dealing with numbers, written on the papyrus which Egypt used for writing-paper. But the Rhind Papyrus is a roll of manuscript eighteen feet long, in very good condition, and dealing entirely with Egyptian mathematics. It is the great mathematical treasure from ancient Egypt.

This manuscript roll was unearthed near the ruins of the great Temple of Rameses II in Thebes almost a century ago, and bought by Henry Rhind, who gave it its name. It found its way into the British Museum. Scholars have studied the ancient roll, or photographs of it, sometimes with despair, sometimes with exultation over their success at understanding some puzzling bit of the Egyptian figuring.

Now, the papyrus is the subject of a big new two-volume publication by the American Mathematical Association, setting forth the latest achievements of science in understanding the mathematical wisdom of the Egyptians.

This one papyrus on Egyptian mathematics does reveal pretty completely what the Egyptians knew about numbers at the very height of their scientific attainments. This is the conclusion of Prof. Arnold B. Chace of Brown University, who, with the assistance of Prof. Henry P. Manning, produced the new publication.

Ahmose, the scribe, who wrote the Egyptian book, gave it an intriguing title. He could have called it "Fundamentals of Mathematics," but he didn't. He called it: "A guide for calculation, with means of ascertaining everything, of elucidating all obscurities, all mysteries, all difficulties."

Geometry for Pyramids

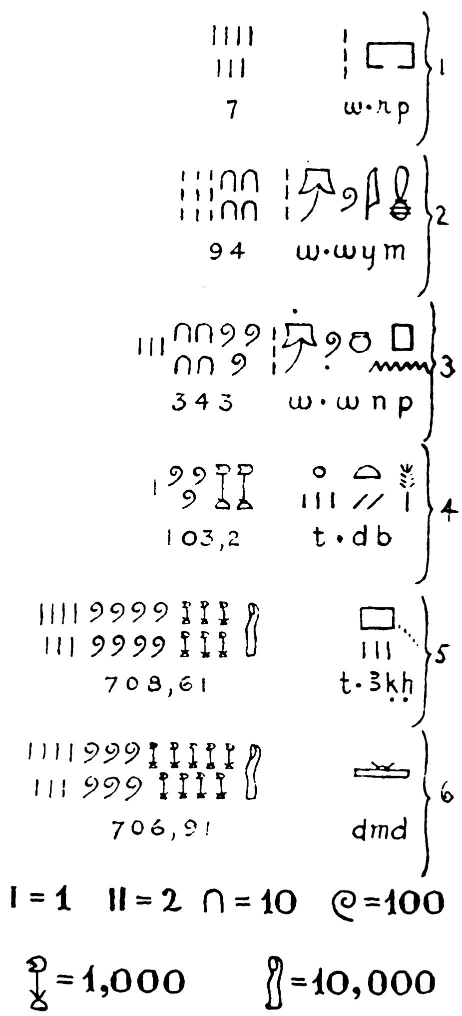
The Egyptian who had this impressive book in his possession is believed to have been an architect, farmer, or school teacher, or some other individual who needed a handy reference book on figures. The book contains problems showing how to use geometry to find the angle of slope of the sides of a pyramid. There are other problems showing how to calculate the amount of grain that can be stored in bins of certain size. There are tables containing the answers to the division of fractions, for ready reference.

And between the lines of the Egyptian writing, we may read the story of how Egyptian schoolboys were taught to multiply and divide and do all the other tricks with figures that they would need when they grew up and took care of Egypt's business.

Egyptian schools taught reading, writing, and arithmetic, and not very much else, except a great many ethical lessons—character education teachers call it today.

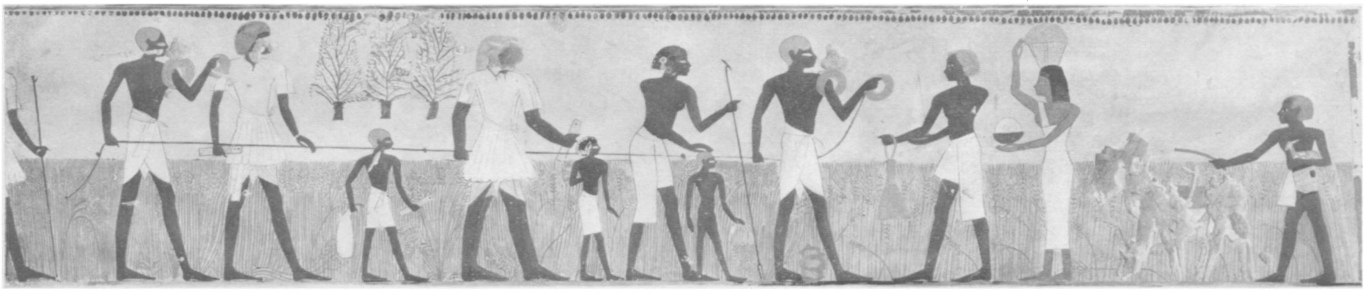
Boys started to school at the age of four, and began doing hard work at once; no kindergarten games. Girls, apparently, did not receive much education, unless tutored at home. After elementary education, a boy who was preparing for temple service, entered a higher temple school. A prospective government clerk or official continued his studies in some government office, learning to draw up reports and to keep accounts.

The scribes who served as Egyptian schoolmasters must have taught their young pupils the processes of adding,



CAT AND MOUSE PROBLEM

In the hieratic style of Egyptian writing, used in the Rhind papyrus, the cat and mouse problem can be read only by an Egyptologist. But here is the same problem translated into Egyptian hieroglyphics, or picture writing, which you can read. Symbols for the numerals are shown in the key, and, remember, read the signs from right to left. The pictures at the right of the figures are the words for houses, cats, mice, spelt, hekat, and total.



CAREFULLY MEASURING A GRAIN FIELD TO CALCULATE ACCURATELY YIELD AND TAXES

subtracting, multiplying and dividing. The Rhind Papyrus shows that the Egyptians had a thorough knowledge of these four basic operations, Prof. Chace declares.

Counted By Tens

Probably, the Egyptian child began by learning to count. The Egyptians counted by tens, as we do today. In the beginning they undoubtedly counted on their ten fingers, a device that every child still naturally returns to in time of doubt. But although the Egyptians counted by tens, they never discovered the convenient device of expressing tens, hundreds, and thousands by establishing a decimal point and measuring off places from it. Consequently, they often had to write out a great many figures in order to do a problem which would be dashed off today in great speed.

Adding has been about the same through history and all over the world. For numbers like five or eight, the Egyptian child marked down vertical bars and counted them as he marked. The first nine numerals in the hieroglyphics or picture writing of ancient Egypt were made up of little vertical bars. Three bars meant 3, seven bars 7. For 10, a horseshore-like symbol served. For 20 there had to be two horseshoes. In hieratic, or script writing, the numerals were written in shorthand symbols. The Rhind Papyrus is in this hieratic writing.

Learning to write the signs for figures and learning to add and subtract must have been primary work for the Egyptian child. It was when he came to multiplication and division that school life became hard.

The Egyptian arithmetic called for learning only two multiplication tables —the 2 table and the 10 table. No other tables, no trying to remember 7 times 9, or 8 times 7! It sounds fine. But wait until you hear what took the place of the "times" tables.

Because the Egyptian had no way of storing those combinations in his memory, so that he could give the answers at the snap of a finger, he had to do slow and tedious figuring on every example. To multiply 15 by 13, the Egyptian boy would go through the following procedure of doubling and adding:

1×15 becomes 15
2×15 becomes 30
4×15 (2×30) becomes 60
8×15 (2×60) becomes 120

He then added his 8 and 4 and 1 times 15 and got the sum of 13 times 15.

This system of doubling and adding, which seems so needlessly slow since mathematicians have worked out a simpler system, was in use in Europe even as late as the Middle Ages.

In order to divide, the Egyptian had to reverse the multiplication process, which made it a shade more complicated.

Egyptian fractions, like Egyptian multiplication, look harmlessly simple when first encountered in Ahmose's old arithmetic text. All fractions except 2/3 had the figure one for the numerator. Because of this limitation in expressing fractions, the Egyptian had to make long mental detours in order to juggle his fractional problems to a right conclusion. That he got the answers is something to wonder at.

Chief Source of Knowledge

The Rhind Papyrus is the chief source of modern knowledge about those Egyptian fractions. It contains the earliest explanation of how the problems were worked out. To express 2/29, for instance, it was necessary for an Egyptian schoolboy to add

1/24, 1/58, 1/174, 1/232

Of course, when the schoolboy grew up and put his arithmetic to use, as an accountant in the government tax-collecting offices, or as a temple scribe who recorded the offerings, he learned shorter cuts to fractional figuring. That is to say, he acquired a reference book, such as the Rhind Papyrus, which would contain long tables giving the result when fractions were broken up into parts which had one for a numerator.

The Egyptian methods in handling fractions seem indeed a triumph of mental ingenuity. But the highest mathematical attainments of the Egyptians are shown, Prof. Chace concludes, in three problems of arithmetical and geometrical progression in the papyrus.

One of these problems which represented Egyptian brain power at its best is singularly interesting, because it seems to be the origin of the familiar riddle that begins, "As I was going to St. Ives, I met a man with 7 wives, each wife had 7 cats," and so on. The Egyptian problem in arithmetical progression is as follows:

"In each of 7 houses are 7 cats, each cat kills 7 mice, each mouse would have eaten 7 ears of spelt, and each ear of spelt will produce 7 kekat of grain. How much grain is thereby saved?"

This problem in the Rhind Papyrus has a mistake in the figuring. The scribe appears to have had a fit of absent-mindedness. He copied down a 3 when he should have written a 4.

The problem of figuring out what would have happened to a household's store of grain, if the cats had not caught the rats, looks a bit far-fetched for any practical purposes. It was, we may believe, a problem simply designed to show how to work arithmetical progression, and the cats and mice merely made it interesting and gave the Egyptians a chuckle. Yet, it is no exaggeration to say that the Egyptians did try to keep track of wheat and other supplies down to the last ear. Estimating the yield of a grain field was a task which called for surveyors, bookkeepers, and perhaps auditors as well, in order that the taxes might be kept straight and the food supply for the future reckoned.

Egyptian boys who were bright at figures might hope to hold responsible posts in the service of Pharaoh or the temple. On the tomb of one scribe who served the Pharaoh Thutmose IV, is a wall painting (*Please turn to page* 220)

ORNITHOLOGY

Geese Are Photographed Flying at High Altitude

A FLOCK of geese accidentally included in a photograph of the sun at Dehra Dun, India, were estimated to be flying at an altitude of 29,000 feet, says Prof. T. H. Harrison of Pembroke College, Cambridge, who has gathered bird flight records.

Among other high fliers are lammergeiers, godwits, curlews and choughs, observed above 20,000 feet on Mt. Everest, and a number of birds thought to be cranes at 15,000 feet. Migratory birds are recorded as flying between 5,000 and 10,000 feet, and one observer has recorded 262 birds crossing the face of the moon from 1,500 to 15,000 feet.

Egrets were observed by night through a telescope 5,000 feet up. The main bulk of bird migration is believed to fly at less than 3,000 feet, however.

Science News Letter, October 3, 1931

Egyptian Schoolboy's Arithmetic

(Continued from Page 215)

which gives some idea of the elaborate statistical procedures sometimes followed.

The painting shows two men surveying one of the Pharaoh's grain fields, ready for harvest. Surveyors were known as "rope stretchers" in popular parlance in Egypt. These two surveyors are shown with their reels of rope, and while they measure, two scribes with tablets stand ready to write down the figures, and three boys carry the scribes' equipment.

In the scene below, the grain bin is being measured, with three scribes standing in a row, busily writing, and another scribe sitting atop of the bin, and four more of the fraternity to the right of the bin. And the chief scribe himself, owner of the tomb, is shown standing in dignity within a shelter and bossing the job.

On the whole, it appears that Egyptian mathematics was quite adequate to the needs of Egyptian business, even if it did take a corporal's squad of scribes to equal one modern adding machine. The achievements, rather than the limitations, of the Egyptian mathematicians are the impressive angle of the case.

Science News Letter, October 3, 1931