Babylonian mathematics

[*From:* Babylonian Mathematics*]

The Babylonians lived in Mesopotamia, present-day Iraq, a fertile plain between the Tigris and Euphrates Rivers. The region had been the center of the Sumerian civilization which flourished before the Babylonians, 5500 years ago. This was an advanced civilization building cities and supporting the people with irrigation systems, a legal system, administration, and even a postal service. Writing developed and counting was based on a sexagesimal system, that is to say base 60. Around 1,200 years later the Akkadians invaded the area and for some time the more backward culture of the Akkadians mixed with the more advanced culture of the Sumerians. The Akkadians invented the abacus as a tool for counting and they developed somewhat clumsy methods of arithmetic with addition, subtraction, multiplication and division, all playing a part. The Sumerians, however, revolted against Akkadian rule and 200 years later they were back in control. However, some time later, the Babylonian civilization replaced that of the Sumerians around 4,000 years ago. The Babylonians were a Semitic people who invaded Mesopotamia and, defeating the Sumerians, established their capital at Babylon.

The Sumerians had developed an abstract form of writing based on cuneiform (wedge-shaped) symbols. Their symbols were written on wet clay tablets which were baked in the hot sun and many thousands of these tablets have survived to this day. It was the use of a stylus on a clay medium that led to the use of cuneiform symbols since curved lines could not be drawn. The later Babylonians adopted the same style of cuneiform writing on clay tablets.

Many of the tablets concern topics which, although not containing deep mathematics, nevertheless are fascinating. For example, it was an important task for the rulers of Mesopotamia to dig canals and to maintain them, because canals were not only necessary for irrigation but also useful for the transport of goods and armies. The rulers or high government officials must have ordered Babylonian mathematicians to calculate the number of workers and days necessary for the building of a canal, and to calculate the total expenses of wages of the workers. There are several Old Babylonian mathematical texts in which various quantities concerning the digging of a canal are asked for.

The Babylonians had an advanced number system, in some ways more advanced than our current systems. It was a positional system with a base of 60 rather than the system with base 10 in widespread use today. The Babylonians divided the day into 24 hours, each hour into 60 minutes, each minute into 60 seconds. This form of counting has survived for 4000 years. To write 5 hours, 25 minutes, 30 seconds is to write the sexagesimal fraction:

$5 \dfrac{25}{60} \dfrac{30}{3600}$. To us, who use numbers to the base 10, the fractions would be: $5 \dfrac{4}{10} \dfrac{2}{100} \dfrac{5}{1000}$

(5 hours and 1,530 seconds) which is written as 5.425 in decimal notation.

Perhaps the most amazing aspect of the Babylonian's calculating skills was their construction of tables to aid calculation. Two tablets found at Senkerah on the Euphrates in 1854 date from 4000 years ago. They give squares of the numbers up to 59 and cubes of the numbers up to 32. The table gives $8^2 = 1,4$ which stands for:

$$8^2 = 1, 4 = 1 \text{ cross } 60 + 4 = 64$$
$$\text{up until} \quad 59^2 = 58, 1 \ (= 58 \text{ cross } 60 + 1 = 3481).$$

*http://www-history.mcs.st-andrews.ac.uk/HistTopics/Babylonian_mathematics.html