Babylonian Mathematics And Babylonian Numerals

History of Mathematics

Babylonian Mathematics refers to mathematics developed in Mesopotamia, from the days of the early Sumerians to the fall of Babylon in 539 BC and is especially known for the development of the Babylonian Numeral System

The fertile land between the Tigris and Euphrates valleys is regarded as the seat of human civilization, the place where humanity first began to develop urban centers and move away from a semi-nomadic existence. This shift in society and the welding together of many disparate tribes into one empire created an explosion in knowledge, as the shift towards agriculture allowed study for study's sake.

The main contribution of the Sumerians and Babylonians was the development of writing with their cuneiform script, an advance that allowed record keeping and knowledge to be preserved and passed down through the generations. Many of these records, preserved on clay tablets, have been discovered by archaeologists and translated, revealing information about the daily life of these ancient people.

These tablets also allow modern historians to delve into the past and explore the sophisticated mathematical techniques of these people, the very foundation of the explosion in mathematics of the later Greeks. While we tend to call the mathematics of this advanced civilization Babylonian, other great cultures such as the Sumerians and Assyrians also contributed to the development of an advanced civilization in the Fertile Crescent.

A modified version of Bill Casselman's photo of YBC 7289, with hand tracings to emphasize the cuneiform markings. (byBill Casselman)

The Babylonian Numerals - Astronomy and Base 60

The Babylonians developed a system for writing down numbers, using symbols for singles, tens, and hundreds, showing that they probably used a decimal system for everyday life. This system allowed them to handle large numbers comfortably and perform all of the major arithmetical functions. However, there is no evidence that they used a number for zero, and they did not use fractions.

Babylonian Numerals (Public Domain)

However, the Sumerians also used a base 60 system of counting, the reason why we still divide a circle into 360 degrees and count hours, minutes, and seconds. This sexagesimal system was used for weights and measures, astronomy, and for the development of mathematical functions. For example, one tablet lists the squares of all of the numbers up to 60^2, and sexagesimal numbering is used for the numbers greater than 60 - 64 is written as 60+4, 81 as 60+21…

This idea of using position to arrange integers, known as the principle of position, is the first known use of such a system, the basis of our decimal system. This became lost until the fifth or sixth century CE, and western culture used the unwieldy Roman system of numbering, a tortuous and difficult system for performing math. Their system of numbering implies that they may have understood zero but, until further evidence is found, that remains largely conjectural.

This base 60 system, also allowed the Babylonians to use fractions, and they expressed a half as '30' (30 sixtieths) and a quarter as '15' (15 sixtieths). This system found its way into Greece and became the preferred way to express fractions until many centuries later, when the decimal system became the preferred language for mathematicians.
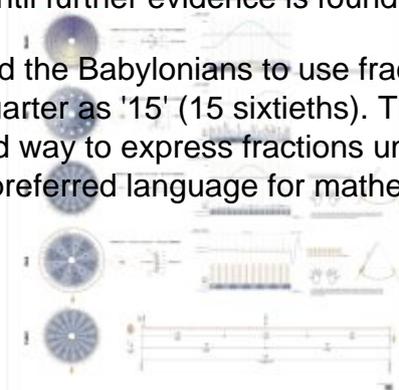
Babylonian tablet listing pythagorean triples (Public Domain)

The accepted reason for the use of a sexagesimal system is that it was based in astronomy and the desire of the Babylonians to develop accurate calendars to chart the turning of the seasons and predict the best times for planting, extremely importantly in a culture with a strong agricultural base. Initially, the Babylonians believed that there were 360 days in a year, and this formed the basis of their numerical system; they divided this into degrees and this represented the daily movement of the sun around the sky. They then transferred this into measuring circles by dividing degrees into minutes. Our entire system of astronomy, geometry, and dividing the day into hours, minutes and seconds hails from this period of history.

Royal Gur of Akkad - Showing Sumerian units of measurement (Creative Common [1]

The Sumerians, Babylonians and other inhabitants of the Euphrates valley certainly made some sophisticated mathematical advances, developing the basis of arithmetic, numerical notation and using fractions. Their work was adopted by the Greeks, and it is likely that the Greeks learned mathematical techniques from the Babylonian culture, as ideas traveled along the Silk Route from Anatolia (Turkey) to China. Alexander the Great is known to have sent astronomical records from Babylonia to Aristotle after he conquered the area.

In geometry, besides the development of degrees, the Babylonians contributed little, tending to use rough approximations, and there is little evidence that they used geometrical techniques for raising their buildings, preferring trial and error. Of course, so little is known about this sophisticated culture that evidence may yet turn up revealing more about their mathematical techniques.

Ultimately, their knowledge passed to the Greeks and formed the basis of pure mathematics as the master manipulators of numbers, the Greeks, took this knowledge and began to explore the relationships between numbers.