

## PTOLEMY

B.C. Mayans, Babylonians, and Egyptians all developed calendars. The Mayans based theirs on sacrificial cycles, and farming. The Babylonians based theirs solely on the lunar cycle, and the Egyptians on the constellations. It is important to note that the Babylonians kept detailed records of lunar eclipses, and kept record of the Sun's path across the sky throughout their year. This is the beginning of astronomical observation.

>322 Aristotle suggests that all planets have a perfect circular orbit, called an epicycle, around the Earth. Ptolemy later elaborates on this idea.

>250 Aristarchus, a Babylonian astronomer, suggests a heliocentric, or sun-centered system of orbits.

>120 Hipparchus introduces his idea of dividing a circle into 360 degrees with each degree divided into sixty minutes. Ptolemy would later use these ideas to further develop trigonometry.

## A.D.

85 This is the date it is presumed that Ptolemy was born. Very little is known about his personal life or family background.

98 Menelaus wrote *Chords in a Circle* using arcs of the zodiac.

127 On March 26, Ptolemy observes the stars and records what he sees. This is the first recorded evidence of his interest in the stars.

>135 Theon made astronomical observations of Mercury and Venus between 127 and 132. Ptolemy lists four observations, which Theon made in 127, 129, 130 and 132.

>165 Ptolemy writes his first and most famous work *Syntaxis*. It is later translated into Arabic and is highly revered, as "The Greatest" which is Arabic is called al-Majisti. The title becomes more widely known as *Almagest*.

In Chapter IX of Book I of *Syntaxis*, Ptolemy calculates chords and arcs of a circle, continuing the work of Hipparchus, and Menelaus. The circumference of a circle is divided into 360 parts and the diameter in 120 units. He develops **Ptolemy's theorem**, which was

a method to calculate the chord of the sum or difference of two arcs. In more common terms, he developed a theory on adding and subtracting sines.

Ptolemy **introduces the Quadrant**, a tool used to measure the elevation of the sun, within *Syntaxis*

Book II is devoted to spherical geometry and common problems like the length of the day at any degree of latitude. He confirms Hipparchus's calculation that the length of a tropical is  $1/300^{\text{th}}$  of a day less than  $365 \frac{1}{4}^{\text{th}}$  days. Both men are later proved to be incorrect. A tropical year is  $1/28^{\text{th}}$  of a day less than  $365 \frac{1}{4}^{\text{th}}$  days.

Book III goes into detail about the length of the year and the motion of the planets.

Book IV is about the length of the months and lunar theory.

Books V-XII continue to focus on astronomy.

Next, Ptolemy wrote *Analemma*. This book explains an orthogonal projection, which is a **two dimensional representation used to chart the position of the sun at any given day**. This idea was used in the construction of sundials.

Another work of Ptolemy's is *Planisphaerium*. This work is an explanation of the stereographic method of projection, where points on a sphere are represented on a plane based on the projection from one point, a pole. He takes the South Pole as his center of projection because he is concerned with maps of the northern hemisphere.

The last collection of books Ptolemy is known to have written is *Optics*. Book V, the last of the collection, is dubbed the most interesting historically since it contains what appears to be one of the **first theories on refraction**. Ptolemy developed experiments using air, glass and water to arrive at his conclusions.

Ptolemy also concerned himself with one of the great mathematical challenges of day, proving Euclid's  $5^{\text{th}}$  postulate. However, his proof was incorrect.

- >1155 Gerard of Cremona, who translated over 85 works, went to Toledo to learn Arabic just so he could read Ptolemy's *Syntaxis*, which did not exist in Latin at the time.
- 1155 Ptolemy's *Syntaxis* was translated from Greek into Latin by Adelard of Bath, who also translated Euclid's Elements from Arabic into Latin.

- 1477 Ptolemy's *Geography (Planisphaerium)* was first printed in Bologna.
- 1500s Gerardus Mercator, describes as the "Ptolemy of our Age" designed the first projection specifically designed for sea travel.
- 1600s *Syntaxis* remains the primary source of information on planetary orbits. Copernicus noticed one of its flaws, however. According to the Ptolemaic system, as a planet moves around in its orbit, its distance from the earth changes, hence its size in the sky should change. Copernicus proposes a new theory, that planets do not revolve about the Sun, but about points removed from the sun. Essentially, he proposed that planets had their own rotations. However, Copernicus's findings were not received well by his contemporaries. Kepler and Galileo continue Copernicus's work, and Ptolemaic system of orbits meets its fall.
- 1935 Ptolemy is honored by his own crater on the moon, Ptolemaeus.
- 1973 Ptolemy is again honored when a crater on Mars is named Ptolemaeus.

## Sources

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