

# Biographical Encyclopedia of Astronomers

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Menelaus of Alexandria

Born Alexandria, (Egypt), circa 70

Died circa 130

Menelaus is best known for his development of spherical trigonometry.

Little is known about the life of Menelaus. It appears that he spent his early years in Alexandria and was probably born there; after that, he seems to have moved to Rome. Pappus and Proclus both referred to him as Menelaus of Alexandria. Ptolemy noted astronomical observations made by Menelaus in Rome on January 14, 98 AD. In addition, Plutarch related a conversation about optics involving Menelaus as an adult in Rome around the same time

Ibn al-Nadim's *Fihrist* (a register of mathematicians, written circa 950) mentions six books by Menelaus, some of which were said to have been translated into Arabic at the time. They included *The Book of Spherical Propositions*, *On the Knowledge of the Weights and Distribution of Different Bodies*, three books on the *Elements of Geometry*, and *The Book on the Triangle*. The only book by Menelaus that can be found today is the first in the list above, generally referred to as the *Sphaerica*

That book documents Menelaus' major contribution to astronomy, which was the development of spherical trigonometry. For example, the first known definition of a spherical triangle appears at the beginning: The Greek term that he used for a spherical triangle, *tripleuron*, was not commonly used by other mathematicians to refer to triangles (although it does occasionally appear in Euclid), and suggests that Menelaus was aware of the originality of his topic. In short, he appears to have been the founder of spherical trigonometry. He is best known today, within that field, for Menelaus' theorem, which has applications to astronomy

In addition to his theoretical work, Menelaus made many astronomical observations and attempted to organize them and make estimates relating to the movement of the stars. Several 10th-century Arab astronomers (al-Battani, al-Sufi, and Hajji-Khalifa) allude to a catalog of fixed stars composed by Menelaus; this was apparently not a complete catalog and was largely based on his observations. Based on Menelaus' observations, Ptolemy suggests that Menelaus was able to estimate that the equinox was moving westward at a rate of  $1^\circ$  per 100 years. (A more accurate figure given today is about  $1^\circ$  per 72 years.) Pappus also mentions a treatise by Menelaus on the settings of the signs of the zodiac. (The calculations in this treatise would have involved the use of trigonometry.)

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