Ptolemy's table of chords

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Famous table of chord lengths according to Ptolemy's *Almagest* (e.g. 1515) converted into decimal values and calculated in comparison using the sine function, see Toomer (1984). Chord lengths l_0 are calculated according to *Ptolemy's theorem* (fig. 1) as the relation between four sides and two diagonals of a cyclic quadrilateral where

$$AC \cdot BD = AB \cdot CD + BC \cdot AD.$$

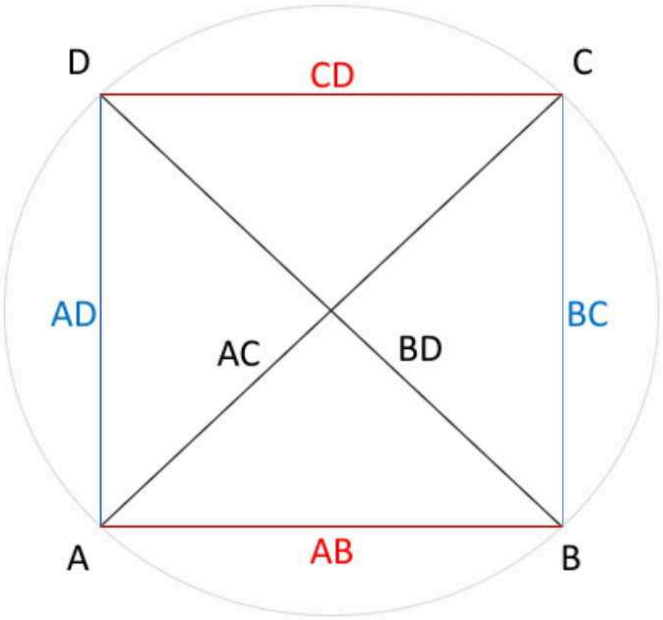

Figure 1: Cyclic quadrilateral.

Chord lengths l_0 (fig. 2) are expressed in fractional parts of sexagesimal numerals $x\ y\ z$. Decimal values l_1 are calculated as

$$l_1 = x + \frac{y}{60} + \frac{z}{60^2}.$$

Sixtieths is the average interpolation number to be added to lenght l_0 or l_1 each time angle increases by one minute of arc, that is $n = 30$ times per half angle degree α.

Lengths l_2 to given arcus α and diameter d are calculated using the sine function where

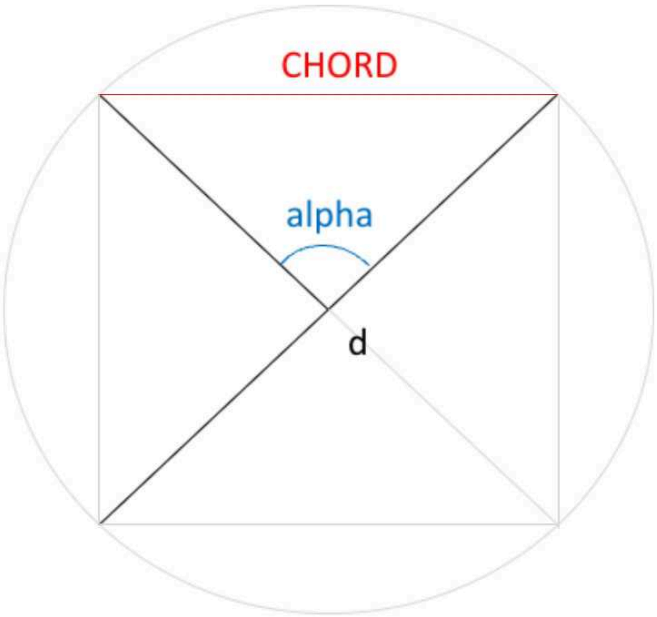

Figure 2: Chord length representation.

$$l_2 = d \cdot sin\frac{\alpha \cdot \pi}{360}.$$

Differences $diff$ show the difference between (1) *sixtieth* and arithmetical interpolation as well as the difference between (2) the calculation types of chord lengths l_1 and l_2, see `chords.md` or `chords.xlsx` tables.

References

Ptolemaeus, C. (1515). *Almagestum CL. Ptolemei Pheludiensis Alexandrini astronomorum principis opus ingens ac nobile omnes celoru motus continens.* Felicibus astris eat in lucem ductu Petri Liechtenstein coloniensis germani ...Venetiis. https://doi.org/10.3931/e-rara-206

Toomer, G. J. (1984). *Ptolemy's Almagest.* Duckworth, London & Springer, New York. https://www.cambridge.org/core/journals/journal-of-hellenic-studies/article/abs/ptolemy-almagest-trans-and-ed-g-j-toomer