

Comparison of Reasoning in Trigonometry in the 17th Century— from Europe to China

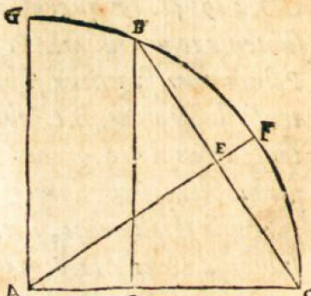
Trigonometry was introduced to China systematically in the early 17th century. The adapted/translated trigonometric treatise *Dace* 大測 (Grand Measure) delineates the knowledge in terms of the construction principles of the table and its usage in applications. Computational procedures to find the sine of one-half of an arc given that of the arc plays a crucial role in constructing of trigonometric tables. In this presentation, we compare the texts of geometric reasoning regarding this computational procedure both in the Latin source and the Chinese treatise. If time allows, we will also examine the algebraic solution to the same procedure that was part of the Latin text but excluded in the Chinese translation.

Latin text

XXXIV. PROBLEMA QVINTVM. Dato sinu arcus, una cum sinu complementi, sinum arcus dimidii reperire.

REGVLA. Quadratum sinus recti arcus dati conjunge cum quadrato sinus versi ejusdem arcus (*quem sinum versum reperies subtracto sinu complementi à radio.*) Radix summæ istorum duorum quadratorum erit subtensa arcus dati: cujus semissis erit sinus arcus dimidii.

RATIO REGVLÆ. Nam sinus rectus & versus aequè possunt sui arcus subtensa. Vt, in adjuncto schemate, BD sinus rectus arcus BC; & DC sinus versus ejusdem arcus, aequè possunt subtensa illius arcus BC. per 50. p. 1. Cujus subtensa dimidium EC, est sinus arcus dimidii FC.



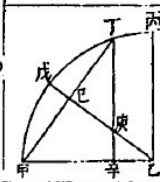
EXEMPLVM. Sit arcus BC. XXX. graduum sinus rectus BD. 5000000. sinus versus DC. 1339746.

Qua-

LIBER SECVNDVS.		43
Quadratum sinus recti BD. erit	— — —	2500000000000000
Quadratum sinus versi DC. erit	— — —	1794919344516
Summa horum duorum quadratorum erit.		26794919344516
Radix inde extracta 5170380. erit subtensa arcus dati BC. XXX. graduum. Dimidium vero illius subtensa, nempe recta EC. 2588190. erit sinus arcus dimidii FC. XV. graduum.		

庚甲兩形之三邊俱等。依句股法得甲庚邊倍之爲甲癸。以減半徑得癸乙爲餘弦。

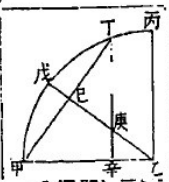
要法三 各弧之全弦上方與其正半弦上借其矢上方并等



句股術也。如上甲丁弧之正弦爲丁辛。其矢爲甲辛。此兩線上方并與甲丁上方等。

系法。有一弧之正弦及其餘弦而求其半弧之正弦。如上甲丁弧其正弦爲丁辛。餘弦爲乙辛。而求甲戊弧。

大測二卷



之甲已半弦其法于甲乙半徑減乙辛餘弦得甲辛矢其上方借丁辛半弦上方并與甲丁通弦上方等。開方得甲丁線半之。

得甲已爲甲戊弧之正弦其數如上甲丁弧三十度其半弦丁辛爲五〇〇〇〇〇〇乙辛餘弦爲八六六二五四以減全半徑得甲辛矢三三九七四六丁辛上方爲二五〇〇〇〇〇〇〇〇〇〇〇〇甲辛上方爲一七九四九一九三四四五一六并之得二六七九四九一九三四四五一六開方得甲丁線五一七六三八

即甲丁弧三十度之弦也半之爲甲已半弦得二五八八一九〇其弧十五度

用前三要法即大測表大畧可作。又有簡法二題其用甚便但非恒有

簡法一 兩正弦之較與六十度左右距等弧之正弦等見本卷第二篇



解曰。甲乙丙象限內有丙已小弧丙已戊丁大弧丙戊弧爲六十度而戊已戊丁兩弧等其前兩正弦一爲已辛一爲丁庚其

大測二卷

較丁癸題言丁癸較與已壬丁兩正弦各等。論曰。試作一已子線則丁已子成三邊等角形。何也。此形中有子丁壬已子兩三角形。此兩角形等。又何也。子壬同腰而丁壬壬已兩腰等。則丁壬已壬兩直角亦等。而丁子子已兩底亦等。子丁已子已丁兩角亦等。又丙戊弧既六十度其餘餘乙弧必三十度。而乙甲戊角爲三十度角。甲乙庚丁既平行。甲戊線截二線于子。即內外角等。而丁子戊角亦三十度。戊子已角亦三十度。是丁子已爲六

十度其餘餘乙弧必三十度。而乙甲戊角爲三十度角。甲乙庚丁既平行。甲戊線截二線于子。即內外角等。而丁子戊角亦三十度。戊子已角亦三十度。是丁子已爲六