A Science Paper

Calculating Planetary Cycles using Geometry.

Lindsay McAuley (Copyright 2015)
3 Essex Court
Buderim 4556
(e) Lfaraway@bigpond.com
(m)0412654 099

ISBN - 987-0-9806975-9-9

Glossary of terms

Orbital parameters

[Astronomical Almanac 2000, p. E3]

Sidereal orbit period (days)	The time it takes the body to make one revolution about the sun relative to the fixed stars in days.
Tropical orbit period (days)	The average time for the body to make one revolution about the sun from one point in its seasonal orbit to the equivalent point (e.g. equinox to equinox) in days. For Earth, this equals exactly 1 year.
Synodic period (days)	The time interval between similar configurations in the orbit of the body and Earth, in days.
Sidereal rotation period	The time for one rotation of the body on its axis relative to the fixed stars, in hours. A minus sign indicates retrograde rotation.
Solar day / Length of day	The average time in hours for the Sun to move from the noon position in the sky at a point on the equator back to the same position, on Earth this defines a 24 hour day.
Jovian Days	(Jovian- of pertaining to Jupiter) The revolution of Jupiter on its axis per Jovian year.
Saturnian Days	Saturnian – (of or pertaining to the planet Saturn) The revolution of Saturn on its axis per Saturian year.
Synodic Month	The synodic month, or complete cycle of phases of the Moon as seen from Earth,
Apsidal nodes	In celestial mechanics, perihelion precession, apsidal precession or orbital precession is the precession (rotation) of the orbit of a celestial body.
Lunar precession	Precession is the rotation of a plane (or its associated perpendicular axis) with respect to a reference plane.
Eclipse season	Eclipse seasons occur slightly less than six months apart (successively occurring every 173.31 days - half of an eclipse year), the time it takes the Sun to travel from one node to the next along the ecliptic.

Eclipse year	Eclipse year is period, with which line of lunar nodes points to the Sun. Line of nodes circle opposite direction to motion of Earth . Eclipse year is shorter than solar tropical year.
Inex cycle	This eclipse is a part of the long period, **Inex** cycle, repeating at alternating nodes, every 358 synodic months (≈ 10,571.95 days, or 29 years minus 20 days). The inex is an eclipse cycle of 10,571.95 days (about 29 years minus 20 days). The cycle was first described in modern times by Crommelin in 1901, but was named by George van den Bergh who studied it half a century later. It has been suggested that the cycle was known to Hipparchos.[1] A new saros series often begins one inex after the last series started.
Metonic cycle	Metonic cycle is a period of very close to 19 years that is remarkable for being nearly a common multiple of the solar year and the synodic lunar month being a period of 19 years, almost exactly equal to 235 synodic months, counts 6,940 days.
Saros cycle	The saros is a period of approximately 223 synodic months (approximately 6585.3211 days, or 18 years and 11 days and 8h), that can be used to predict eclipses.
Lens	In geometry, a lens is a biconvex (convex-convex) shape comprising two circular arcs, joined at their endpoints.

Index

Abstract:

This article strives to develop a model for evaluating the hypothetical correlation between geometry with the orbital time cycles of the visible planets in our solar system. This work establishes a ratio and proportion synchronicity using predominately elementary mathematical calculations. Two interlocked circles of equal radius is the basic foundation of this investigation.

This model is used to suggest there exists a highly accurate connection between orbital time frequencies and axis revolutions with mathematical calculations determined from analysis of inscribed and bounded object properties of a circular geometric image. The process produces results of approximately 99.50 % accuracy or usually significantly less than 2.3% percentage error.

This work provides a novel approach with which to study the complexities of the forth co-ordinate[1], - (time). This is achieved by evaluating the correlation between complex astronomy systems and geometry of which circles form the basic design.

Historically, circles were a crucial geometric shape used in most scientific investigations of astronomy until ellipses provided proof of the orbital mechanics of the solar system. This work seeks to revitalise the circle as a credible method of mathematically studying the solar system.

Introduction

Centuries ago, when ancient astronomers first viewed the night sky, they would have noticed that some objects, known today as planets, moved slowly amongst the background of fixed stars in a repeated, orderly fashion. Because they, like the sun and moon, appeared and reappeared in a consistent manner, suggested to the observer their positions may be predictable. Mankind thus began the search for mathematical patterns which has led us to our understanding of astronomy today.

The **Venus tablet of Ammisaduqa** (*Enuma Anu Enlil* Tablet 63) refers to the record of astronomical observations of Venus, as preserved in numerous cuneiform tablets dating from the first millennium BCE.

A method of predicting the motions of planets was to map their positions against the star field background and then to apply mathematics or geometry to the changing positions. This required a dedicated observation of the night sky, gradually building upon an accumulated body of shared knowledge from which to develop theories. It was the illusion of the sky appearing to move from one side of the horizon to the other while the ground seemed stationary that gave credence to the geocentric (earth centred) view of the world.

When one views the 360 degree horizon, it is easy to see how the geometric shape of a circle became central from which to form the basis of cosmological and spiritual thought with the observer at the centre surrounded by a perfect circle. Many ancient indigenous tribes often established a circle before performing any spiritual ceremony.

The circle has no beginning and no end. Similarly, it may have held true to the ancient astronomer that the universe was considered to hold the same eternal qualities.

Invariably, it was the circle which became the natural geometric foundation for any analysis of the universe often venerated with its qualities of perfection. This was not only as a result of observations of the night sky but also a spiritual bases relative to the theological influences of the time. It was believed that if the Creator of the universe were to make the cosmos work in perfect harmony, it was naturally concluded that a circle would be at the heart of any design. In Christian symbolism, the circle represents eternity. Therefore, any attempt to investigate this discipline and to achieve credibility within the scientific and religious community of the day, circles and spheres became salient features from which to develop workable models.

It has been recorded that Aristarchus of Samos[2], (c. 310 – c. 230 BC) an ancient Greek astronomer and mathematician, presented one of the earliest known models which placed the sun at the centre with the earth revolving around it within the perceived spherical universe. (*Journal of Astronomical History and Heritage (ISSN 1440-2807), Vol. 11, No. 1, p. 39 - 49 (2008).* Liritzis, Ioannis*;* Coucouzeli, Alexandra *).*

Until as recent as a couple of centuries ago the circular orbit theory held weight being the bench mark for most calculations and opinions on the mechanics of the solar system. It was the geocentric model with the earth as being at the centre that won favour for over 2,000 years. Christian theologians were prone to rejecting theories that did not agree with the fact that earth was the centre of the universe and nothing other than a perfect circle should be the prime instrument used to investigate the heavens.

Circles dominated the Ptolemaic system[3], a mathematical model of the universe formulated by the Alexandrian astronomer and mathematician Ptolemy about 150 AD and recorded by him in his, 'Almagest and Planetary Hypotheses'. The Ptolemaic system is a geocentric cosmology that describes the earth being stationary at the centre of the universe and the surrounding sun and planets depicted by a series of orbiting circles. Epicycles were added to explain visual irregularities such as the mars retrograde. The natural expectation was that the heavenly bodies must travel in uniform motion around the earth along the most perfect route possible, a circular orbit.
(ir.nmu.org.ua/bitstream/.../dc480e68d659d20361017f0e12c6d2db.pdf.1)

In Egypt, located at the site of Deir-el-Bahri, in the tomb of Senemut[4] (Theban tomb no. 353) the earliest depictions of the solar system is illustrated with a series of circles dating back to the 18th Dynasty (ca.

1473 B.C.).

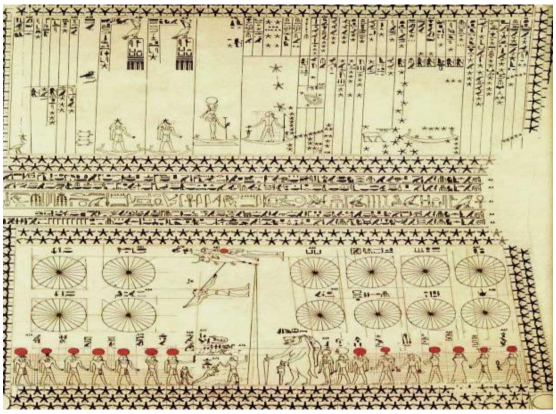
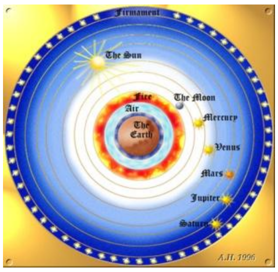
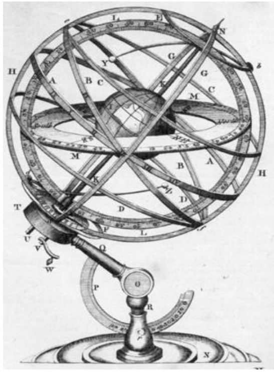


Figure 2. Astronomical ceiling decoration in its earliest form can be traced to the Tomb of Senemut (Theban tomb no. 353)



The ancient Greeks also understood it to be logical that the motions of the planets were circular and not elliptical. (www.atnf.csiro.au/outreach/education/senior/cosmicengine/classicalastronomy.html#palto) An Athenian and pupil of Socrates, Plato[5] believed the universe was perfect and unchanging and that the stars were eternal and divine, embedded in an outer sphere. All heavenly motions were circular or spherical as the sphere was considered to be the perfect shape.



The geocentric system held credibility well into the early modern age. From the late 16th century, it was gradually replaced by the heliocentric (sun centred) system of Copernicus[6], Galileo[7] and Kepler[8]. Although many early cosmologists such as Aristarchus speculated about the motion of the earth around a stationary sun, it was not until the 16th century that Copernicus presented a fully predictive mathematical model of a heliocentric system, which was later elaborated on by Kepler and defended by Galileo.

Through the course of thousands of years of scientific scrutiny of planetary movements, it was the circle which played a central role until eventually they fell out of favour replaced by the science proof provided by ellipses.

According to M. Beech in the *Journal of Recreational Mathematics* **29** (2), *114 – 120.),*

> *"Before Kepler made his scientific eureka moment, documenting his three laws in the 16th century, he found it difficult to relinquish his earlier work concerning circular geometric modelling. Kepler's Mysterium Cosmographicum (image 1) proposed that the distance of the orbits of the planets from the sun could be calculated using a series of geometric shapes alluding to a direct mathematical link between geometry and the solar system. Kepler argued that the ratio of orbital radii for Venus and Mercury was the same, or nearly so, as the ratio of the radii for the circumscribed and inscribed spheres of an octahedron".*

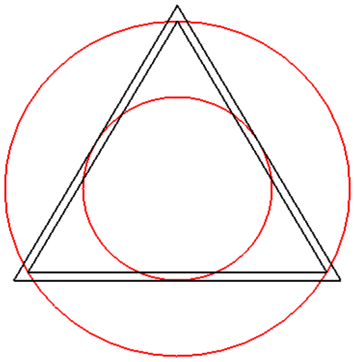


Figure 1. The inscribed and circumscribed triangles to the orbits of Jupiter and Saturn.

M. Beech continues.

> *"Kepler's initial inspiration to study planetary geometry was conceived while teaching an astronomy class at the University of Turbingen, in Germany, on July 9th, 1595 [2]. During the class, he had drawn for his students the inscribed and circumscribed circles to an equilateral triangle where he realised that the ratio of the radii for the inscribed and circumscribed circles was the same as the ratio of orbital radii of Saturn and Jupiter".*
>
> *Kepler could not believe that the coincidence of ratios was purely fortuitous. There had, he reasoned, to be meaning behind such a result. However, the planets simply do not arrange themselves in accordance with Kepler's polygonal scheme. Having found that the planets could not be organised according to a progression of polygons, he turned to three dimensional objects and developed the nested polyhedral model which he described in the Mysterium Cosmographicum.*

It seems that Kepler never completely abandoned the ideas presented in his *Mysterium*, although he did admit that his nested polyhedron theory had its weaknesses.

Having cleaned the astronomy stables of circles and spirals, I was left with only a single cartful of dung.

Johannes Kepler (1571 -1630)

This work is an extension to that same line of cosmological analysis, that is, our solar system may be calculated using geometry as a framework for investigation.

The earth is the primary reference point for astronomers when calculating the mathematics of space. The distance from the sun is described as 1 AU. When analysing the orbits of other planets, generally their characteristics are defined relative to the axis revolution of the earth. Similarly, this work adopts the earth as the central reference point. As opposed to examining the physical distance of the planets from the sun, this process looks at time duration only.

It is a step back in time in a sense, yet ironically, it is using the mathematics of planetary time in a circular environment, where this research is fundamentally centred.

Time is probably the most complex paradigm to attempt to seek an empirical explanation. Although modern civilisation has made advances in all areas of science, it seems that 'time' has seen very little substantial development in understanding remaining an abstract concept across the general community. It is time that was the critical element that formed the basis of all observations throughout the entire history of astronomy and remains so today.

The suggestion that astronomy cycles can be reconciled using number and geometry is a concept that is deep-rooted in humanity's investigation of the universe. It is against the historical context of geometry used in astronomy and contemporary scientific knowledge of elliptical orbits that this work forms a challenging new perspective. It seeks to revitalise the circle as a credible means to investigate the mechanics of the solar system. The hypothesis has been developed where the properties of circles and their inscribed and bounded objects can be used to develop relationships whereby the orbital characteristics of planets in our solar system may be determined with considerable accuracy.

"Philosophy is written in that great book which ever lies before our eyes — I mean the universe — but we cannot understand it if we do not first learn the language and grasp the symbols, in which it is written. This book is written in the mathematical language, and the symbols are triangles, circles and other geometrical figures, without

whose help it is impossible to comprehend a single word of it; without which one wanders in vain through a dark labyrinth"

Galileo Galilei (1564-1642)

1.0 Methods and materials

The geometric correlation between our solar system and geometry.

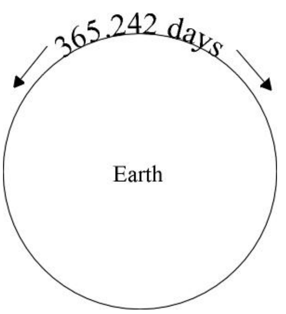
The establishment of a circle using a compass, or, on a computer screen is the first part of the process. Although the earth's orbit is elliptical, in this exercise, let the circumference be identified in length identical to the tropical orbit of the earth, i.e., 365.242 days.

This work uses time as a measurement system as opposed to metric or imperial. This unit of measurement is used in ratio and proportion throughout the entire paper. It is a matter of comparing the measurements calculated from within this simple geometric drawing to astronomy time cycles. I used cross- referencing to compile the geometric calculations in this work. The results of geometric measurements are compared with information obtained from NASA's website- http:/nssdc.nasa.gov/planetary/factsheet.html as well as other astronomy- based websites.

Any measurement which correlates with astronomy cycles being above 97.6% accurate are considered relevant from which to form the basis of an understanding of the inherent synchronicity. Importantly, this is a crucial part of this examination, that is, to recognise as valid and significant results that are approximate.

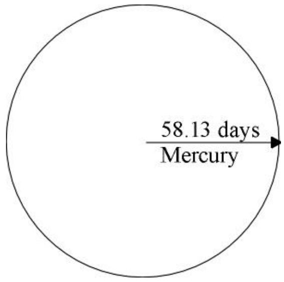
The following is an analysis of one circle which introduces the process.

Dia. 1.1



Having established the circumference as the length of earth's solar tropical year, begin by comparing the radius to other astronomy cycles.

Dia. 1.2



Circumference= 365.242(days)
Geometric measure for Mercury sidereal rotation
=C / (2*pi)
= 365.242 / (2*pi)
= 58.13

Radius = 58.13 (days)
NASA-Mercury rotation = 58.64
Percentage error- 0.9%

Here we find our first comparative measurement to that of the rotation of Mercury with a percentage error of 0.9% As other measurements within this circle are compared to astronomical cycles, additional scientific information begins to emerge.

Dia.1.3

Circumference= 365.242
Geometric measurement for Saturn orbit
= C^2 / (4*pi)
= 365.242^2 / (4*pi)
= 10,615.75

Area = 10,615.75
NASA-Saturn orbit- 10,746.9
Percentage error- -1.22%

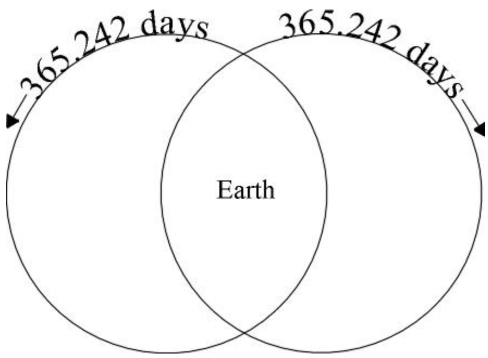
See Appendix 1 for further mathematical analysis of one circle.

2.0 Two interlocked circles

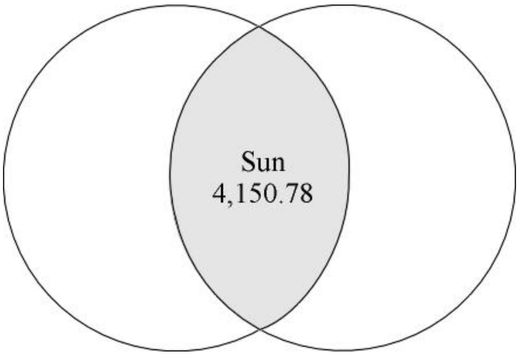
The previous diagrams demonstrate the process of how the mathematics of just one circle can be used as a foundation to calculate planetary time cycles. Adding a second circle to make two interlocked circles, dramatically increases the amount of scientific information. Another circle of equal radius is scribed upon the perimeter of the original circle to form two interlocked circles. The central almond shape is referred to as a ' lens'.

The circumference remains at 365.242 days-(C).

Dia. 2.1



Dia. 3.1
<u>Solar maximum</u>



Geometric Measure for solar maximum

Circumference = 365.242
= C^2/(4*pi^2)***(120***pi/180 – sin(120))
= 365.242^2/(4*pi^2)*1.22837
= 4150.78

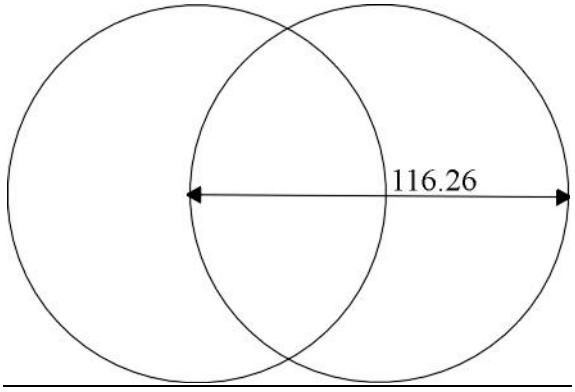
Geometric measurement of lens area	4150.78 (days)

By comparison:

NASA - Solar Maximum	11.1 years	4054.1 (days)

Variation 96.68 (days)
Percentage accuracy 102.38%
Percentage error 2.380%

Dia. 4.1
Mercury - Synodic period



Geometric measurement for Mercury synodic period

Circumference= 365.242
= C / pi
= 365.242/pi
=116.26

Diameter of circle -	116.26 (days)

By comparison:

NASA-Mercury's synodic period	115. 88 (days)

Variation +.38
Percentage accuracy 100.32%
Percentage error 0.3279%

See Appendix 2 for further mathematical analysis of two circles.

Results

Table 2

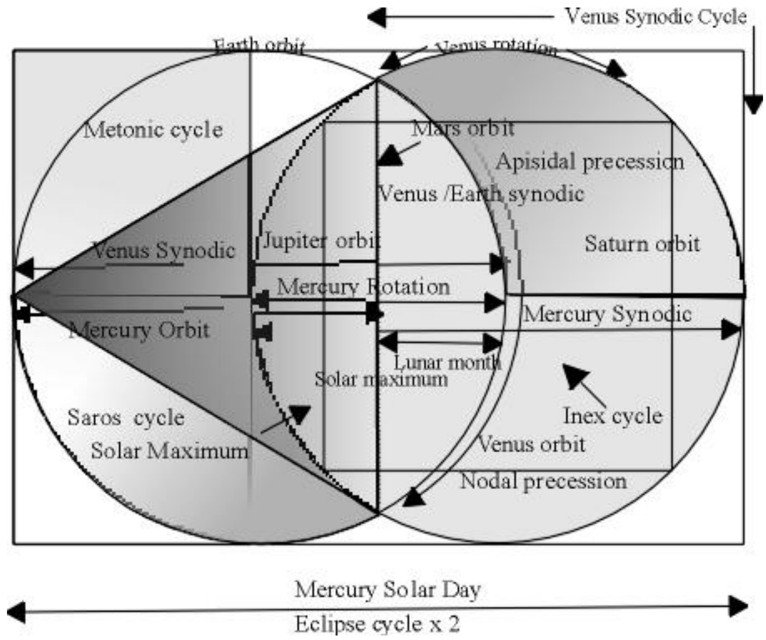
Solar System reference	Characteristic	Geometric relationship Solar Tropical Year C = 365.242 Diameter = C / pi Radius = C / (2*pi)	Process	Reference
Sun	Solar Maximum	2*[C/(2*pi)]^2* (**120***pi/180 – sin(120))	2*Area of segment (area of overlapping circles) NOTE: angles are in degrees	3.1
Mercury	Synodic cycle	C / pi	Diameter of circle	4.1
	Sidereal rotation (Axis rotation)	C / (2*pi)	Radius of circle	4.2
	Sidereal Orbit	3/2 * C / (2*pi)	Midpoint between two circles (1.5 times the radius)	4.3
	Solar day (length of day)	3/2 * C / pi	Width of two interlocked circles (1.5 times the diameter)	4.4
Venus	Synodic cycle	5 * C / pi	Perimeter of rectangle	5.1
	Sidereal rotation	2/3 * C	2/3 of the circumference circle	5.2
	Sidereal Orbit	C/(2*pi)*(3+sqrt(3)/2)	Width of two interlocked circles + ½ chord length.	5.3
	Solar day	C / pi	Diameter of circle	5.4
	Eight year Venus -Earth synodic cycle	sqrt(3)* [C/(2*pi)]^2 / 2	Area of rhombus enclosed by ellipse (shaded) = p*q/2	5.5
Earth	Synodic cycle	n/a	-	
	Tropical Orbit	C	Circumference of circle	6.1
	Sidereal year	C	Circumference of circle	6.2
	Solar day	N/a	-	
Mars	Synodic cycle	C*[2 + sqrt(3)/(4*pi)]	2 x circumference + ½ ellipse	7.1
	Sidereal rotation	C*[1 + 3*Sqrt(3)/(2*pi)]	Circumference + perimeter of inscribed equilateral triangle	7.2
	Sidereal Orbit	C*(4/3 + sqrt(3)/pi)	Length of lens + 2/3 circle x 2	7.3
	Solar day	n/a		
Jupiter	Synodic Cycle	5*C / pi - C/2	Perimeter of bounded rectangle - half of circumference	8.1
	Sidereal rotation	N/a		
	Sidereal Orbit	(C/pi*1.5/sqrt(3))^2*sqrt(3) /4	Area of inscribed triangle	8.2

	Jovian days	C^2 / (4*pi)	Area of circle	8.3
Saturn	Synodic cycle	C/pi * (1 + (1.5)^2)	Diameter (1 circle) + Length of (2 circles + 1/2 width of (2 circles)	9.1
	Sidereal orbit	C^2 / (4*pi)	Area of circle	9.2
	Sidereal rotation	N/a		
	Saturnian days	Sqrt(3)*C^2 / (3*pi)	2/3 circumference x length of chord	9.3
Earth's Moon	Synodic month	C / (4*pi)	Half radius	10.1
	Apsidal precession	C^2/(8*pi) – C^2/(8*pi^2)(120 * pi/180 – sin (120degrees)	Area of half a circle minus area of a segment (shaded) NOTE: angles are in degrees	10.2
	Lunar Nodal Precession	C^2/(2*pi^2)	Area of 1/2 squared circle	10.3
	Lunar Nodal Precession (2)	(C/pi)^2/2	Inscribed square	10.4
Eclipse cycles	Eclipse season	3*C/(2*pi)	Width of two interlocked circles	11.1
	Eclipse year	3*C/pi	Diameter of two circles plus height	11.2
	Inex cycle	C^2/(4*pi)	Area of circle	11.3
	Metonic	C^2/(2*pi^2)+C/2	Area of rectangle enclosing ½ circle + 0.5 circumference	11.4
	Saros	C^2/(4*pi) – C^2/(4*pi^2)(120 * pi/180 – sin (120 degrees)	Area of circle minus area of 2 segments	11.5
Speed of light	Ratio of speed of earth to speed of light	1: 3*C^2/(2*pi)^2	Half the area of the rectangle encompassing the two overlapping circles	12.1

Table 2

	MEASUREMENT IN TWO CIRCLES (DAYS) (experimental value)	**COMPARATIVE ASTRONOMY DATA (DAYS) (theoretical value)**	**PERCENTAGE ACCURACY %**	**VARAIATION (DAYS)**	**Percentage error %**
SUN:					
Solar maximum	4150.78	4054.1 (11.1 years)	102.38%	+96.68	+2.380%
MERCURY:					
Synodic	116.26	115.87	100.32%	+.38	+0.3279%
Axis rotation	58.13	58.65	99.11	-.52	-0.8866%
Orbit	87.15	87.96	99.12	-.77	-0.8754%
Solar day	174.3	175.9	99.09	-1.6	-0.9096%
VENUS:					
Synodic cycle	581.3	583.92	99.5513%	-2.62	-0.4487%
Orbit	243.49	243.1	100.197%	+.48	-0.1975%
Axis rotation	224.7	224.7	100%	00	0.0000%
Solar day	116.26	-116.75	99.58%	-.49	-0.4197%
Conjunctions earth	2926.38	2919.67	100.22%	+6.7	0.2298%
EARTH:					
Tropical year	365.24	365.24	100.00%	0	0%
Sidereal year	366.242	365.242	99.27%	1	-0.2738%
MARS:					
Synodic	780.78	779.9	100.1153%	+.92	+0.1154%
Solar days	667.294	668.59	99.80%	-1.29	-0.1938%
Orbit	688.3	686.9	100.20%	-1.4	+0.2038%
JUPITER:					
Synodic cycle	398.5	398.88	99.94%	-.02	-0.0501
Orbit	4389.32	4332.82	101.30%	+ 56.5	+1.304%
Solar day	10,615.75	10475.8	101.33%	+ 139.5	+1.3359%
SATURN			`		
Synodic cycle	377.7	378.1	99.89%	-0.4	-0.1058
Orbit	10,615.75	10,746.94	98.77%	+131.19	-1.2207
Saturian days	24,516.01	24,491	100.102	25.01	+0.1021
MOON:					
Synodic cycle	29.06	29.53	98.40%	-.47	-1.5916%
Apsidal nodes	3232.5	3232.5	100%	0.0	0.0%
Lunar precession	6758.19	6793.35	99.48%	35.16	-0.5176%
ECLIPSECYCLES					
Eclipse season	174.3	173.31	100.57%	+.99	+0.577%
Eclipse year	348.78	346.3	100.716%	+2.48	+0.7161%
Inex cycle	10,615.75	10,571.95	100.41%	+43.85	+0.4143%
Metonic cycle	6940.8	6939.6	100.017%	+1.2	+0.0172 %
Saros cycle	6464.6	6585.3	98.16%	-120.7	-1.8239%

Dia 13



Discussion

This article initially proposed that a geometric model comprised two circles could be used to evaluate relatively accurate orbital time frequencies of the planets in our solar system.

It has been demonstrated that there is a means to calculate astronomy data using predominately elementary mathematical processes. Indeed, it has been shown that dissecting just one circle produces some significant results. Comparative results of two interlocked circles yield percentage error results in some cases, as accurate as 0.3% error. It was noted that the further away a planet is from earth, the comparative measurements became slightly less accurate.

Conclusion

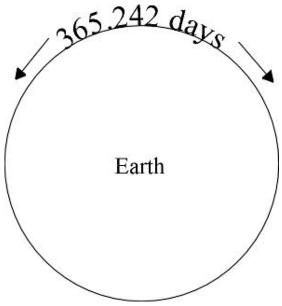
The theoretical process of comparing geometric bounding and inscribed properties of circle measurements with orbital time values from our solar system has proved that a synchronicity exists beyond the normal scope of what could be termed a coincidence. See diagram 13 for evidence of the calculations occurring simultaneously where the reference point, earth's orbit of 365.242 days, is applied to the circumference.

The suggestion by these results alludes to the hypothesises that time must conform to an invisible geometric pattern. Applications for this research could lead to a further understanding of the birth of the universe, the mechanics of the solar system or, the nature of physics compelled to conform within the structural boundaries of a geometric circular framework. Perhaps this hypothesis could be applied to other solar system dynamics throughout the universe. Additional scientific information could be derived using additional circles maintaining a circumference equal to 365.242 days scribed around a central circle.

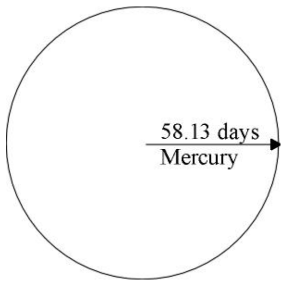
Appendix 1

One circle

Dia. 1.1



Dia. 1.2

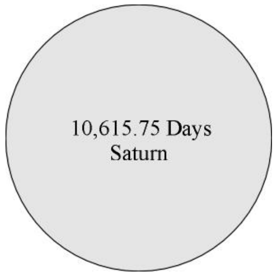


Geometric measurement for Mercury sidereal rotation
=C / (2*pi)
= 365.242 / (2*pi)
= 58.13

Radius = 58.13 (days)
NASA-Mercury rotation = 58.64
Percentage error- 0.9%

\

Dia.1.3

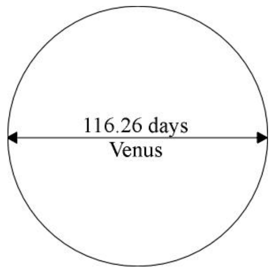


Geometric measurement for Saturn orbit
= C^2 / (4*pi)
= 365.242^2 / (4*pi)
= 10,615.75

Area = 10,615.75 (days)
NASA-Saturn orbit- 10,746.9 (days)

Percentage error- -1.22%

Dia. 1.4



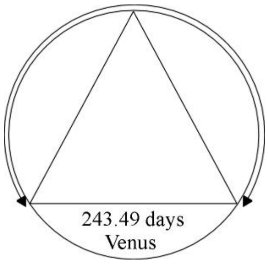
Geometric measure for Venus solar day
=C / pi
= 365.242 / pi
= 116.26

Diameter – 116.26 (days)
NASA – Venus - Solar day- 116.75(days)

Percentage error 0.41%

As the circumference of the circle is dissected into three equal parts forming a triangle, the results become more encompassing.

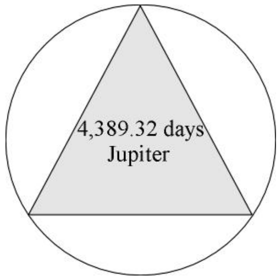
Dia. 1.5



Geometric measure for Venus rotation period
= 2/3 * C
= 2/3 * 365.242
= 243.49

Arc length = 243.49
NASA- Venus axis rotation – 243.1
Percentage error -0.41%

Dia.1.6



Geometric measurement for Jupiter orbit
Area of inscribed triangle = length of triangle^2 * sqrt(3) / 4

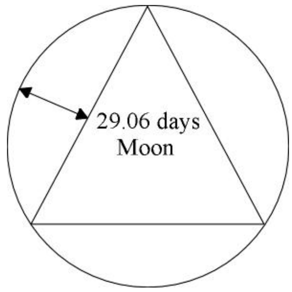
= (C/pi*1.5/sqrt(3))^2 * sqrt(3) / 4

= (365.242/pi*1.5/sqrt(3))^2 * sqrt(3) / 4

= 4389.586 days

Area of triangle - 4389.32
NASA - Jupiter orbit 4332.82
Percentage error 1.304%

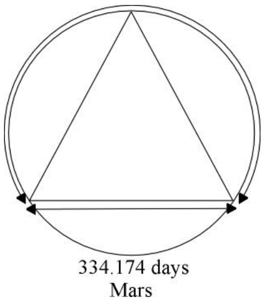
Dia.1.7



Geometric measurement for lunar synodic month
= C / (4*pi)
= 365.243 / (4*pi)
=29.06

Geometric measure = 29.06 (days)
NASA -Moon synodic - 29.53 (days)
Percentage error -1.59%

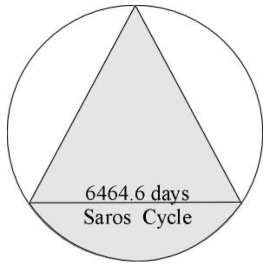
Dia.1.8



Geometric measurement for Mars orbit
= C*(4/3 + sqrt(3)/pi)
=365.242*(4/3 + sqrt(3)/pi)/2
= 688.3

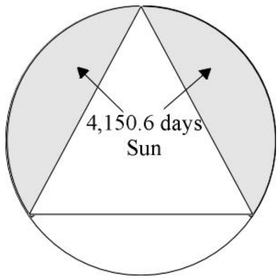
Perimeter = 344.17
NASA -. 5 ($^1/_2$) of mars year
344.17 x 2 = 686.9
percentage error – 0.2

Dia.1.9



Area = 6464.6
NASA - Saros cycle- 6466.1
percentage error – 0.0217%

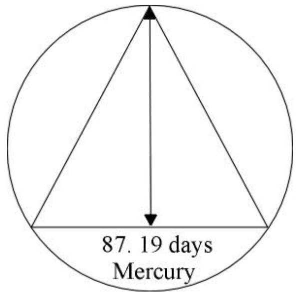
Dia.1.10



Geometric Measure for solar maximum
= C^2/(4*pi^2)***(120***pi/180 – sin(120))
= 365.242^2/(4*pi^2)*1.22837
= 3379.105*1.22837
= 4150.78

Shaded Area = 4150.6
NASA -Solar maximum- 4054.1
percentage error +2.380%

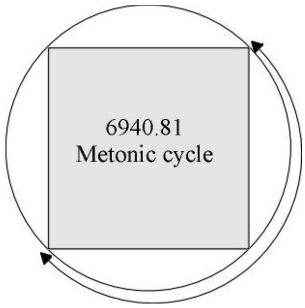
Dia. 1.11



Geometric measurement for Mercury Sidereal orbit
= 3/2 * C / (2*pi)
= 3/2 * 365.242 / (2*pi)
=87.19

Height of Triangle = 87.19 (days)
NASA - Mercury sidereal period – 87.96 (days)
Percentage error -0.9096

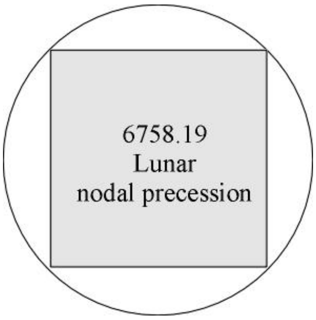
Dia. 1.12



Area + half circumference= 6940.81
= C^2/(2*pi^2)+C/2
= 365.242^2/(2*pi^2)+365.242/2
= 6,940.8

Variation 1.2 days
NASA Metonic cycle – 6939.6
Percentage error 0.017%

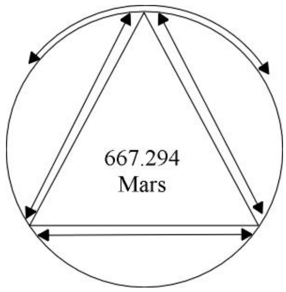
Dia. 1.13



Geometric measurement for nodal precession
= C^2/(2*pi^2)
= 365.242^2/(2*pi^2)
=67658.19

Variation 34.8 days (days)
NASA - Nodal precession 6793.35(days)
Percentage error 0.51%

Dia. 1.14



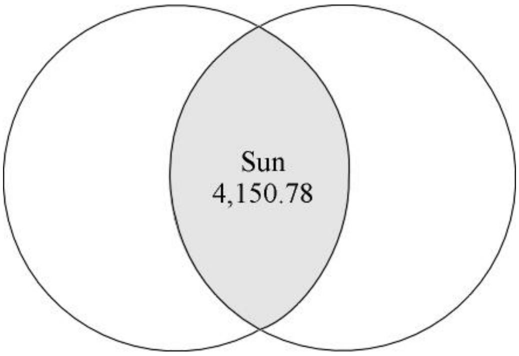
Geometric measurement for Mars solar days
=C*[1 + 3*Sqrt(3)/(2*pi)]
=365.242*(1 + 3*sqrt(3)/(2*pi))
= 667.294

Circumference of circle (365.242) + perimeter of triangle (100.684)
Variation 1.39 days
NASA - 668.59
Percentage error -0.1944%

Appendix 2
Two circles

3.0 Sun

Dia. 3.1
Solar maximum



Geometric Measure for solar maximum
= C^2/(4*pi^2)***(120***pi/180 – sin(120))
= 365.242^2/(4*pi^2)*1.22837
= 3379.105*1.22837
= 4150.78

Geometric measurement of lens area	4150.78 (days)

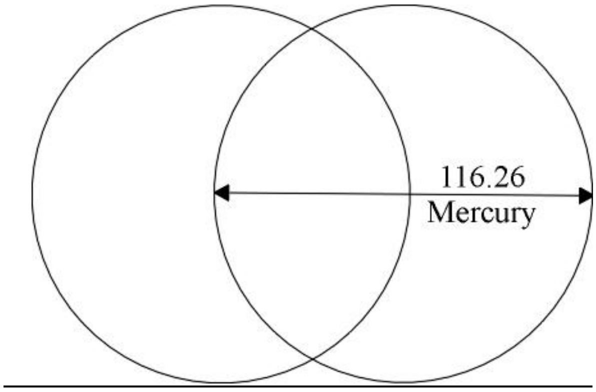
By comparison:

NASA - Solar Maximum	11.1 years	4054.1 (days)

Variation 96.68 (days)
Percentage accuracy 102.38%
Percentage error 2.380%

4.0 Mercury.

Dia. 4.1
Mercury - Synodic period



Geometric measure for Mercury synodic period
= C / pi
= 365.242 / pi
= 116.26

Diameter of circle -	116.26 (days)

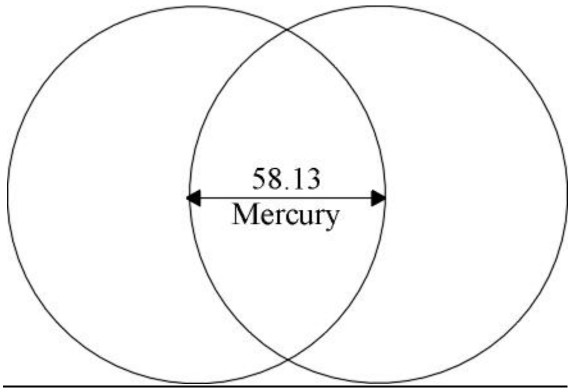
By comparison:

NASA-Mercury's synodic period	115. 88 (days)

Variation +.38
Percentage accuracy   100.32%
Percentage error   0.3279%

Dia. 4.2

Mercury – Sidereal rotation period



Geometric measure for Mercury sidereal rotation
=C / (2*pi)
= 365.242 / (2*pi)
= 58.13

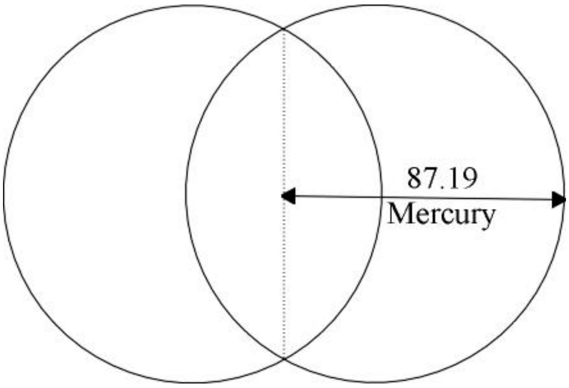
Radius of circle (s)	58.13 (days)

By comparison:

NASA- Mercury's Sidereal rotation period	58.65(days)

Variation -.52 (days)
Percentage accuracy 99.11%
Percentage error -0.8866%

Dia. 4.3
Mercury – Sidereal Orbit



Geometric measurement for Mercury Sidereal orbit
= 3/2 * C / (2*pi)
= 3/2 * 365.242 / (2*pi)
=87.19

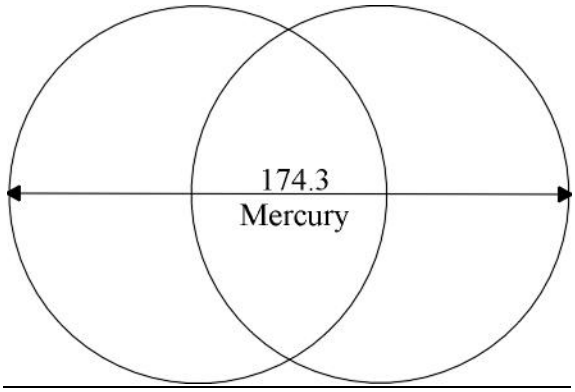
Midpoint of two interlocked circles -	87.19 (days)

By comparison:

NASA- Mercury's Sidereal orbit	87.96 (days)

Variation -.77 (days)
Percentage accuracy 99.12%
Percentage error -0.8754%

Dia. 4.4
Mercury-Solar day



Geometric Measurement for Mercury Solar day
= 3/2 * C / pi
= 3/2 * 365.242 / pi
= 174.3

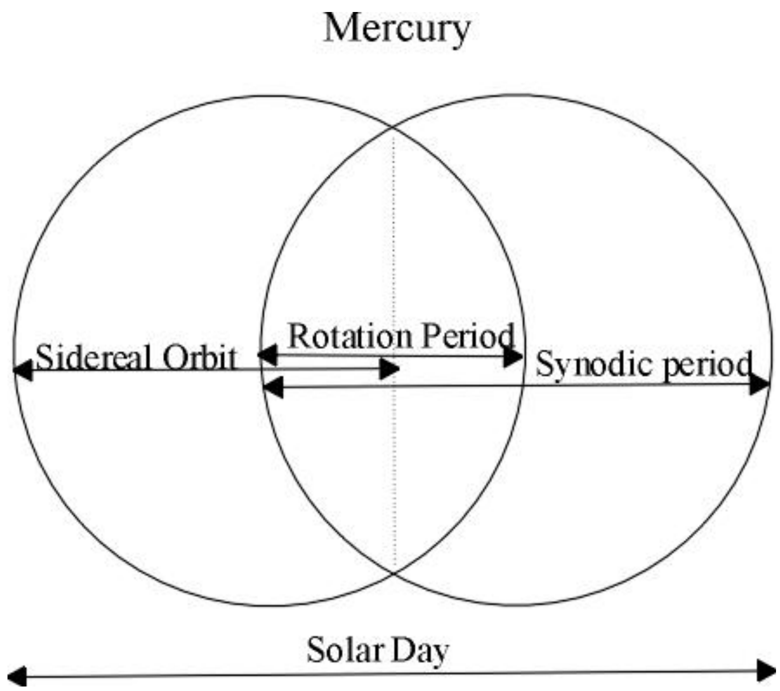
Geometric measurement	174.3 (days)

by comparison:

NASA	Solar day	175.9 (days)

Variation -1.6 days
Percentage accuracy 99.09%
Percentage error 0.9096%

Dia. 4.5

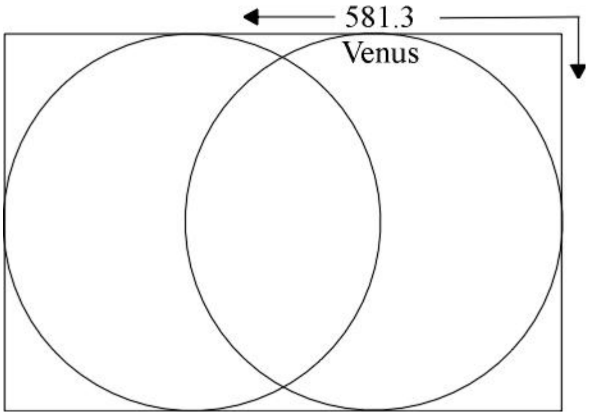


As demonstrated in Diagram 4.5, a pattern begins to emerge with Mercury which presents itself as a scientific observation worthwhile pursuing further; that just two circles and their dissecting points can be described as a planetary orbital calculation model. This suggests characteristics of other planets in our solar system may also be derived using mathematics.

5.0 Venus

The following diagrams show mathematical evidence of Venus cycles. For clarity, the previous Mercury references are omitted. Needless to say, their mathematical data is still present while the circumference remains at 365.242.

Dia. 5.1
Venus-Synodic period



Geometric Measurement for Venus synodic period
= 5 * C / pi
= 5 * 365.242 / pi
= 581.3

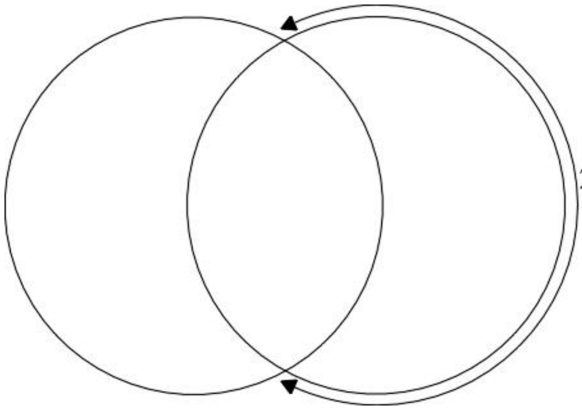
Geometric perimeter	581.3 (days)

By comparison:

NASA- Venus synodic cycle	583.92 (days)

Variation -2.62 (days)
Percentage accuracy 99.55%
Percentage error -0.4478%

Dia. 5.2
Venus - Sidereal Rotation period



Geometric measure for Venus rotation period
= 2/3 * C
= 2/3 * 365.242
= 243.49

Geometric measurement	243. 49(days)

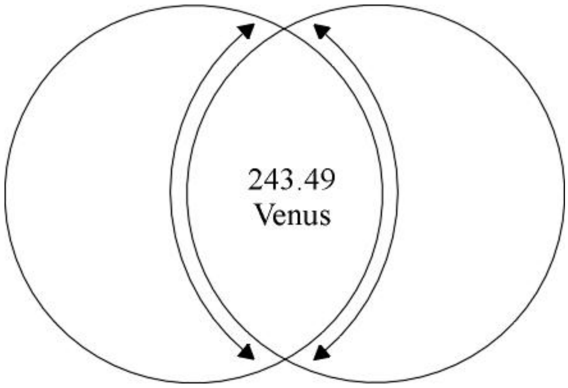
By comparison:

NASA- sidereal rotation period	243.01 (days)

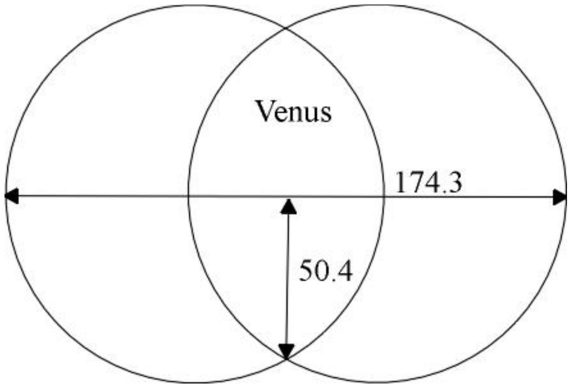
Variation +.48 (days)
Percentage accuracy 100.197%
Percentage error 0.1975%

Additional method of calculating Venus rotation period

Geometric measure for Venus rotation period
= 2/3 * C
= 2/3 * 365.242
= 243.49



Dia. 5.3
Venus- Sidereal Orbit



Geometric measure for Sidereal orbit
= C/(2*pi)*(3+sqrt(3)/2)
= 365.242/(2*pi) *(3+sqrt(3)/2)
= 224.7

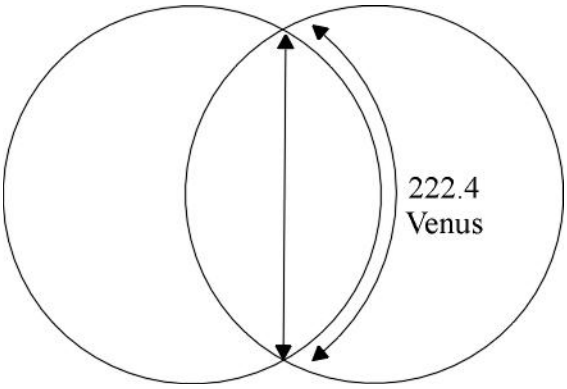
Geometric length	224.7 (days)

By comparison:

NASA-orbit of the sun	224.7 (days)

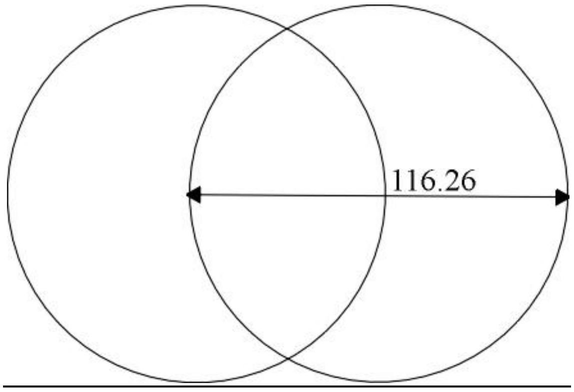
Variation - 0 (days)
Percentage accuracy 100.00 %
Percentage error 0.000 %

Additional methods of calculating Venus sidereal orbit



Geometric measure for Venus sidereal orbit
=C
Chord = 100.684
=(365.242/3) + 100.684
= 222.43

Dia. 5.4
Venus -Solar day



Geometric measure for Venus solar day
=C / pi
= 365.242 / pi
= 116.26

Geometric length	116.26(days)

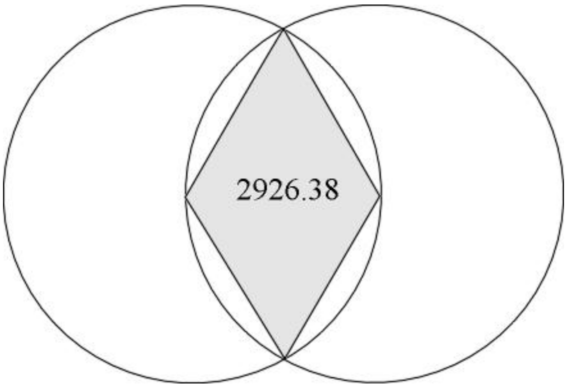
By comparison:

NASA- Venus solar day	-116.75(days)

Variation -.49 (days)
Percentage accuracy 99.58%
Percentage error -0.4197%

Venus/Earth synodic conjunctions

Dia. 5.5
Comparative Synodic cycles

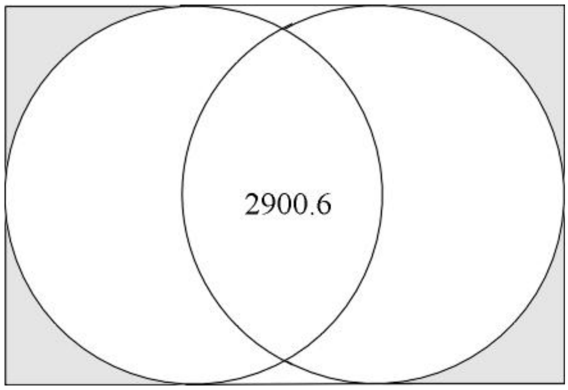


Geometric measure for Venus/ Earth synodic conjunctions
= sqrt(3)* [C/(2*pi)]^2 / 2
= sqrt(3) * (365.242/(2*pi))^2/2
= 2926.38

Geometric area measurement	2926.38 (days)
By comparison:	
8 earth years	2922.0 4(days)
13 Venus years	2921.03 (days)
5 Venus/earth synodic periods	2919.41(days)
12 Venus rotations	2916.22 (days)
Mean	2919.67

Variation 6.7(days)
Percentage accuracy 100.22%
Percentage error 0.2298 %

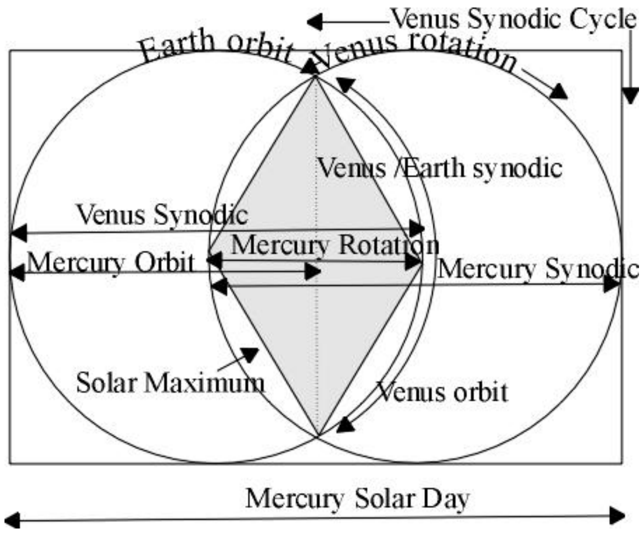
Alternative Venus/Earth synodic calculations



Shaded area = 725.15 x 4
= 2900.6

Variation – 19 days
Percentage accuracy 99.34%
Percentage error – 0.6508

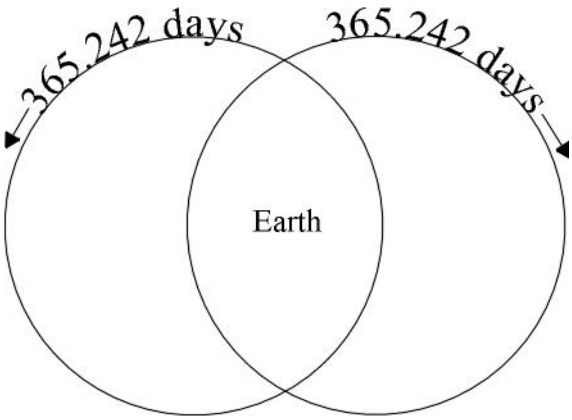
Dia. 5.5
Sun, Mercury, Venus



The above diagram shows the combined statistics of the Sun, Earth, Mercury and Venus to reinforce the proof that a single image holds simultaneous evidence of astronomical data using relatively elementary mathematical calculations.

6.0 Earth

Dia. 6.1
Tropical orbit



Geometric for earth- circumference
= C
= 365.242

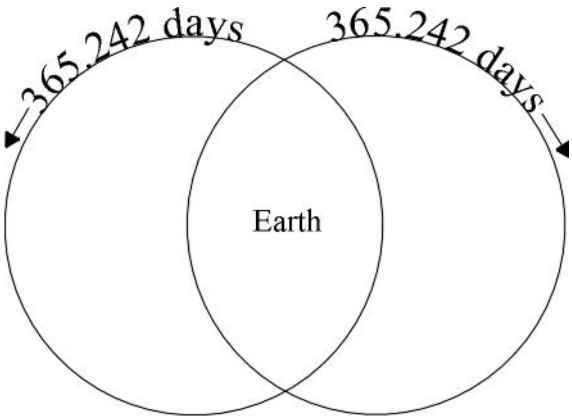
Geometric measure	365.242

By comparison:

NASA- Earth – Tropical orbit	365.242

Variation - 0 days
Percentage accuracy 100%
percentage error -0.000 %

Dia. 6.1
Sidereal days



Geometric measurement for Earth sidereal period

= C
= 365.242
= 365.242

Geometric measure	365.242

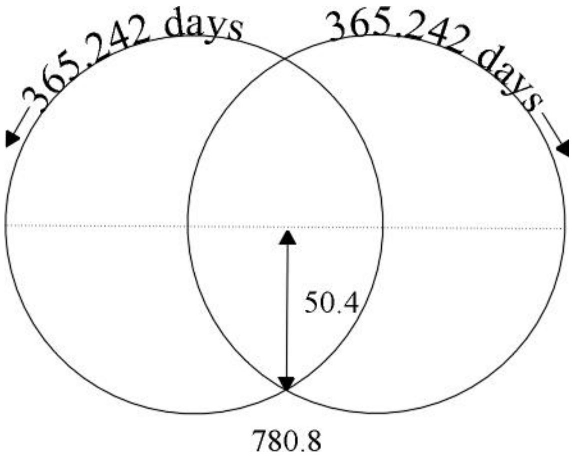
By comparison:

NASA Earth – Sidereal days	366.242

Variation 1 day
Percentage accuracy 99.7269%
percentage error -0.2738 %

7.0 Mars

Dia. 7.1
Mars Synodic period



Geometric measurement for Mars synodic period
C*[2 + sqrt(3)/(4*pi)]
=365.242*[2 + sqrt(3)/(4*pi)]
= 780.8

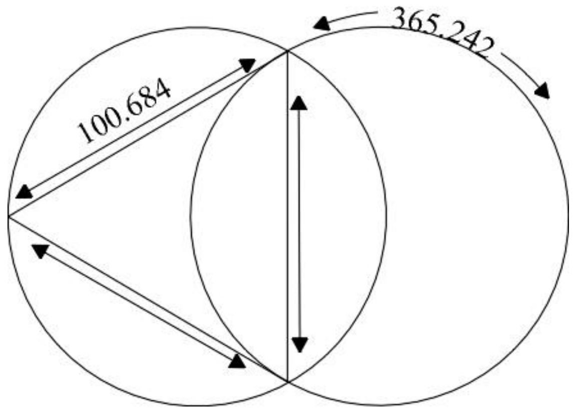
Geometric measurement	780.8 (days)

By comparison:

NASA- Synodic period-	779.9 (days)

Variation + 0.9261 (days)
Percentage accuracy 100.1153%
Percentage error 0.1154%

Dia. 7.2
Mars Solar days



Geometric measurement for Mars solar days
=C*[1 + 3*Sqrt(3)/(2*pi)]
=365.242*(1 + 3*sqrt(3)/(2*pi))
= 667.294

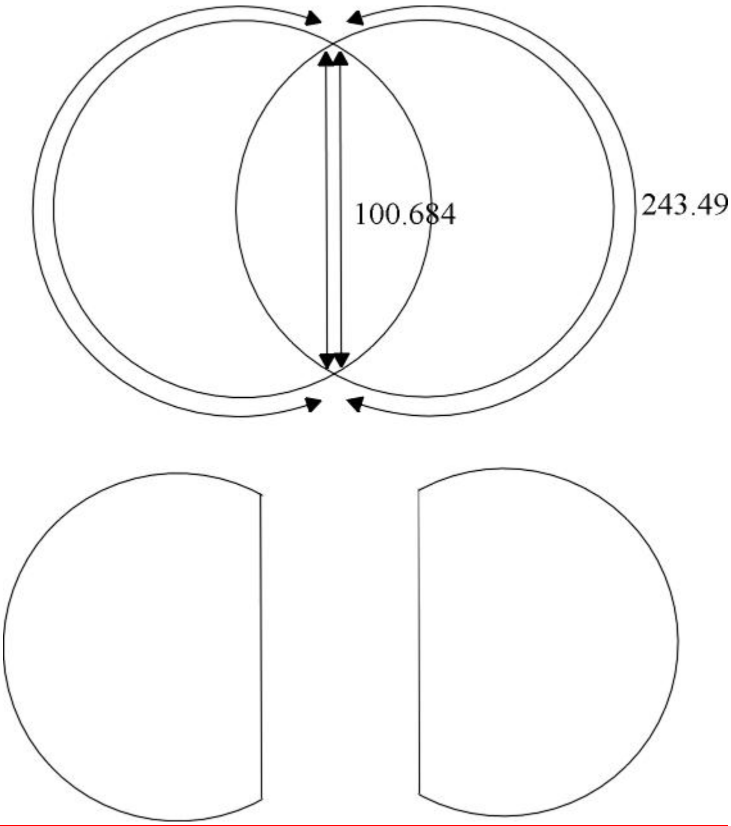
Geometric measurement	667.294(days)

by comparison:

NASA- Mars Solar days	668.59 (days)

Variation 1.29 days
Percentage accuracy 99.8061
Percentage error -0.1938%

Dia. 7.3
Mars Sidereal orbit period



Geometric measurement for Mars orbit
= C*(4/3 + sqrt(3)/pi)
=365.242*(4/3 + sqrt(3)/pi)
= 688.3

Geometric measure	688.3 (days)

By comparison:

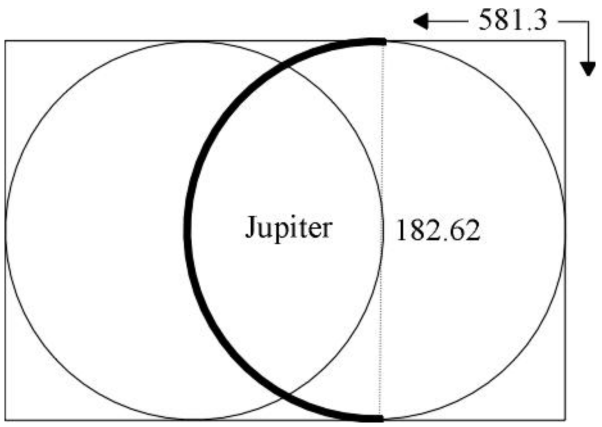
NASA- Mars Sidereal orbit period-	686.9 (days)

Variation +1.4 (days)
Percentage accuracy 100.20 %
Percentage error 0.2038%

8.0 Jupiter

Dia. 8.1

Synodic period



Geometric measurement for Jupiter synodic period
= 5 * C / pi - C/2
= 5 * 365.242 / pi - 365.242/2
=398.5

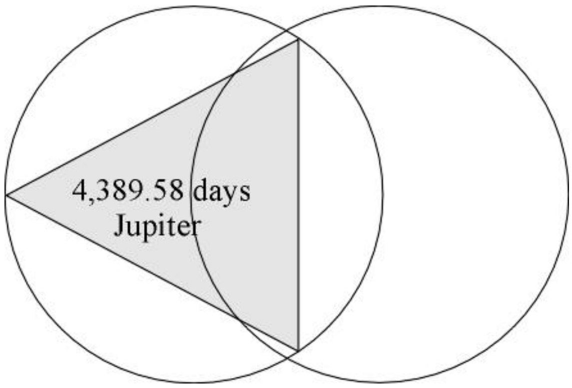
Geometric measure	398.5 (days)

By comparison:

NASA- Jupiter synodic period	398.88 (days)

Variation 0.2 (days)
Percentage accuracy 99.9498%
Percentage error 0.0501%

Dia. 8.2
Jupiter - Sidereal orbit period



Area of inscribed triangle = length of triangle^2 * sqrt(3) / 4

= (C/pi*1.5/sqrt(3))^2 * sqrt(3) / 4

= (365.242/pi*1.5/sqrt(3))^2 * sqrt(3) / 4

= 4389.586 days

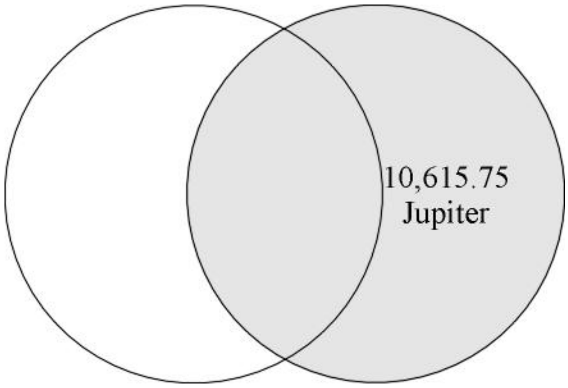
Area of triangle	4,389.58 (days)

By comparison:

NASA Jupiter Sidereal orbit period-	4332.82 (days)

Variation 56.52 (days)
Percentage accuracy 101.30%
Percentage error 1.304%

Dia. 8.3
Jupiter Solar days



Geometric measurement for Jupiter solar days
= C^2 / (4*pi)
= 365.242^2 / (4*pi)
= 10615.75

Geometric measure	10,615. 75(days)

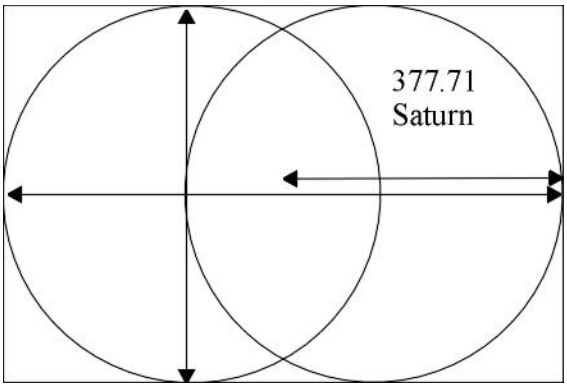
By comparison:

NASA Solar day	10,475.8 (days)

Variation 139.9 days
Percentage accuracy 101.3359%
Percentage error + 1.3359%

9.0 Saturn

Dia.9.1
Synodic cycle



Geometric measurement for Saturn synodic cycle

1.5*Length of Rectangle + Diameter

= 1.5*1.5*Diameter + Diameter

= Diameter ((1.5)^2+1)

= C/pi * (1 + (1.5)^2)

= 377.845

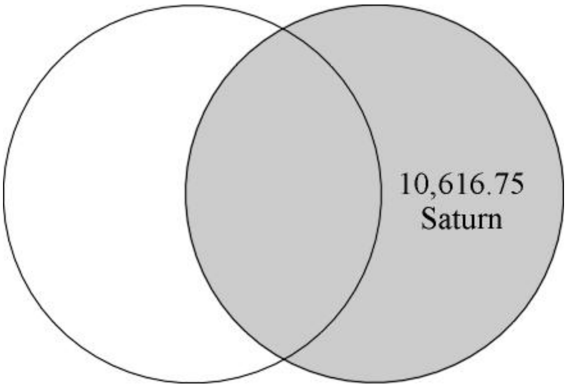
Geometric measure	377.8 (days)

By comparison:

NASA - Saturn synodic cycle	378.1 (days)

Variation 0.4 (days)
Percentage accuracy 99.8942 %
Percentage error -0.1058 %

Dia.9.2
Orbit of sun



Geometric measurement for Saturn orbit
= C^2 / (4*pi)
= 365.242^2 / (4*pi)
= 10,615.75

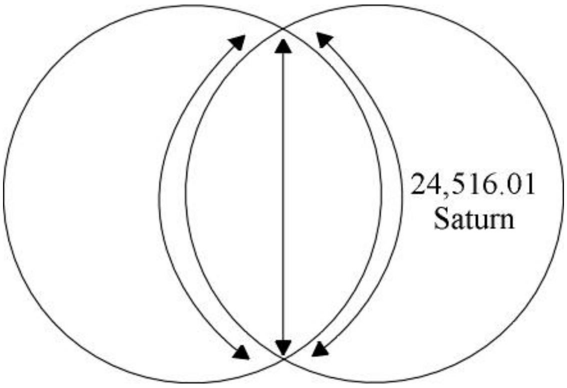
Geometric measurement	10, 615.75 (days)

By comparison:

NASA Saturn's tropical orbit -	10,746.94 (days)

Variation 131.19 (days)
Percentage accuracy 98.77%
Percentage error -1.2207%

Dia. 9.2
Saturnian Solar days per saturnian year



Geometric measurement for Saturnian days
= Sqrt(3)*C^2 / (3*pi)
=365.242/3 x 2 = 243.4 x length of Lens- 100.684
= 24,516.4

Geometric measure	24,516.4 (days)

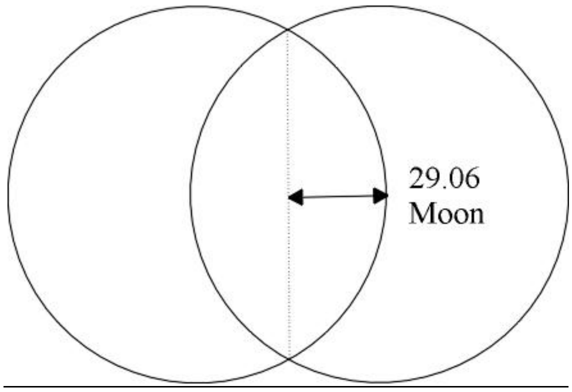
by comparison:

NASA- Saturn Solar Day	24,491 (days)

Variation 25.01 days
Percentage accuracy 100.102
Percentage error 0.1021%

10.0 Moon

Dia. 10.1
Synodic month



Geometric measurement for lunar synodic month
= C / (4*pi)
= 365.243 / (4*pi)
=29.06

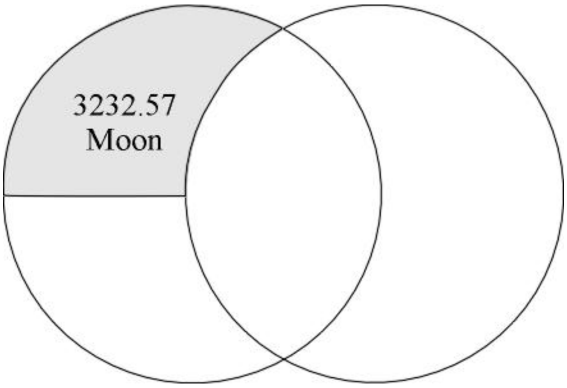
Geometric measurement	29.06 (days)

By comparison:

NASA Mean synodic month	29.53 (days)

Variation -.47 (days)
Percentage accuracy 98.40%
Percentage error -1.5916%

Dia. 10.2
Apisidal precession



Area shaded = half area of circle minus area of segment created by chord of intersection

= pi*r^2/2 – r^2/2*(120radians – sin 120degrees)

= C^2/(8*pi) – C^2/(8*pi^2)(120 * pi/180 – sin (120degrees)

= 365.242^2/(8*pi) – 365.242^2/(8*pi^2)(120 * pi/180 – sin (120degrees)

= 3232.5 days

Geometric measurement	3232.5(days)

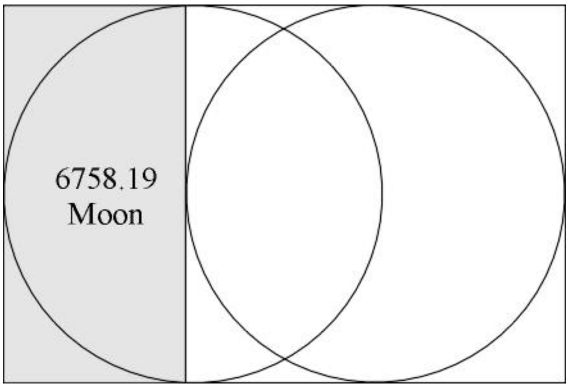
By comparison:

NASA Apisidal precession	3232.5 (days)

Variation 0(days)
Percentage accuracy 100%
Percentage error 0.0%

Dia. 10.3

<u>Lunar nodal precession</u>



Geometric measurement for nodal precession
= C^2/(2*pi^2)
= 365.242^2/(2*pi^2)
=67658.19

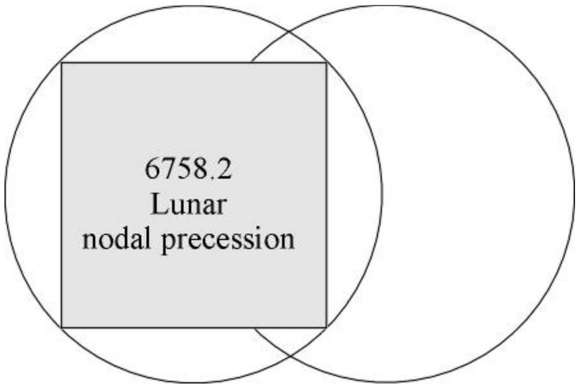
Geometric measurement	6758.19 days)

By comparison:

NASA Nodal precession	6793.35(days)

Variation 35.16 (days)
Percentage accuracy 99.4824%
Percentage error 0.5176%

Dia. 10.4
Alternative Lunar nodal precession

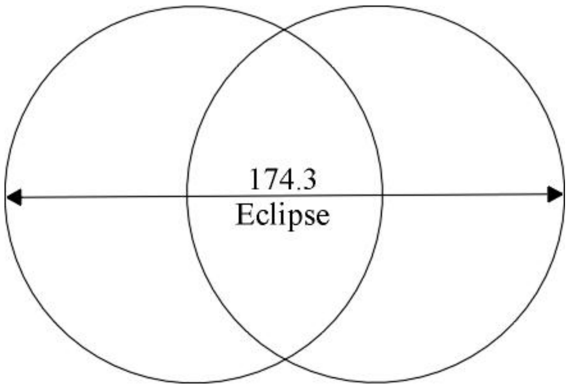


= (C/pi)^2^2
= (365.242/pi)^2/2
= 6758.2

Variation 35.16 (days)
Percentage accuracy 99.4824%
Percentage error 0.5176%

11.0 Eclipse cycles.

Dia. 11.1
Eclipse season



Geometric measure for Eclipse season
= 3*C/(2*pi)
= 3*365.242/(2*pi)
= 174.39

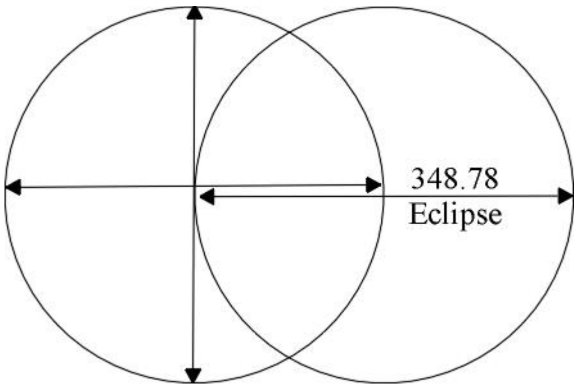
Width of two interlocked circles	174.3 (days)

By comparison:

NASA- Eclipse season	173.31 (days)

Variation + .99 (days)
Percentage accuracy 100.5770%
Percentage error 0.577%

Dia. 11.2
Eclipse year



Geometric measurement for Eclipse year
=3*C/pi
=3*365.242/pi
= 348.78

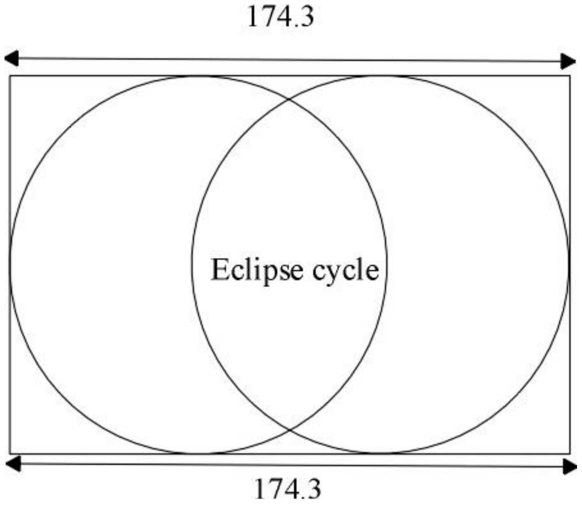
Geometric measurement	348.78 (days)

By comparison:

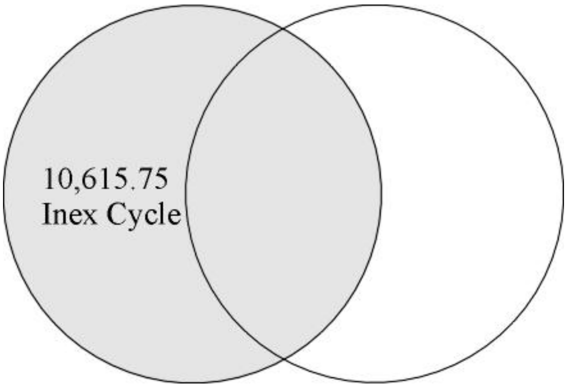
NASA- Eclipse season	346.3 (days)

Variation +2.48 (days)
Percentage accuracy 100.716%
Percentage error 0.7161%

Alternative Eclipse cycle
174.3 x 2 = 348.6



Dia. 11.3
Inex cycle



Geometric measure for Inex cycle
= C^2/(4*pi)
= 365.242^2/(4*pi)
= 10, 615.75

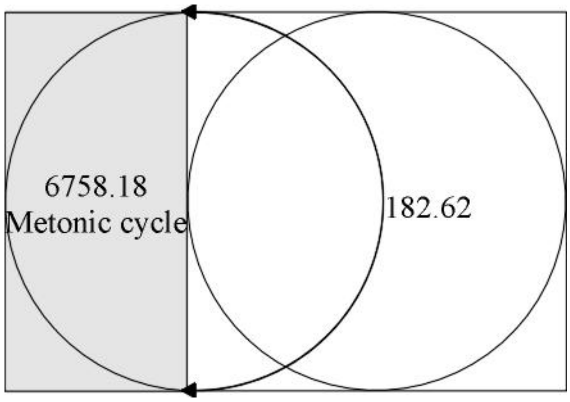
Area of one circle	10,615.75(days)

By comparison:

Inex eclipse cycle	10,571.95 (days)

Variation 43.85 (days)
Percentage accuracy   100.4143
Percentage error   0.4143%

Dia.11.4
Metonic cycle



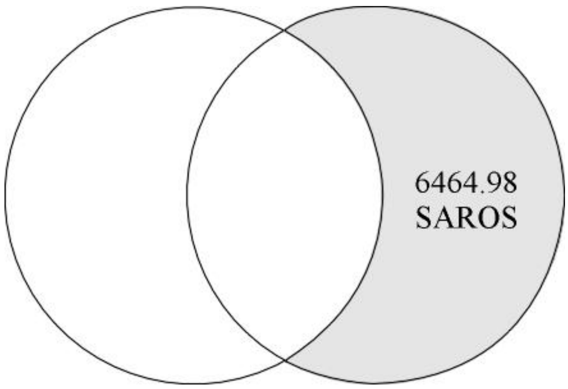
Geometric measure for Metonic cycle
= C^2/(2*pi^2)+C/2
= 365.242^2/(2*pi^2)+365.242/2
= 6,940.8

Geometric measure	6940.8 (days)

NASA- Metonic cycle	6939.6 (days)

Variation 1.2 days
Percentage accuracy 100.0172%
Percentage error 0.0172%

Dia. 11.5
Saros cycle



Area shaded = area of circle minus area of lens created by chord of intersection

= pi*r^2 – r^2*(120*pi/180 – sin 120 degrees)

= C^2/(4*pi) – C^2/(4*pi^2)(120 * pi/180 – sin (120 degrees)

= 365.242^2/(4*pi) – 365.242^2/(4*pi^2)(120 * pi/180 – sin (120 degrees)

= 6464.98 days

Geometric measurement	6464.98 (days)

By comparison:

NASA-Saros cycle	6585.3(days)

Variation +120.7(days)
Percentage accuracy 98.1671%
Percentage error 1.8329%

12.0 Ratio of speed of light / speed of earth

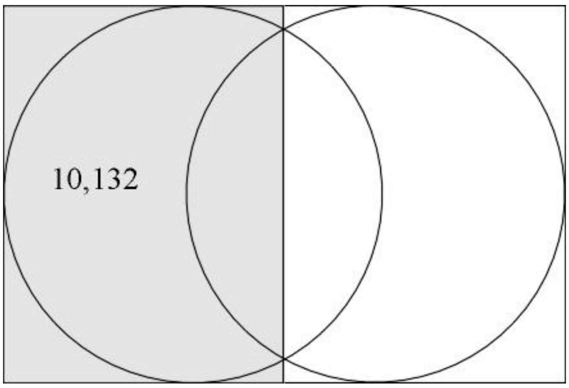
Calculations which involve the study of time invariably includes the speed of light (c). Current estimates suggest this to be 299,792.485 kilometres per second in a vacuum. In this context of using geometry and the solar tropical year to measure time, there should also be some effort to seek out a means to establish a method for calculating the speed of light however arbitrary the process may be perceived. The following geometric calculations determine the comparative ratio of the speed of earth on its orbit around the sun with that of the speed of light. This ratio is generally known as 1:10,066.

Therefore; the ratio of 1 unit (day) to the area of the square (days)-(116.26 x 87.15 = 10,132,) is equal to the ratio of the speed of earth to the speed of light. Based on the above calculations, the percentage error is 0.6557%.

The speed of the earth is not constant therefore the calculations must factor in this variation.

Geometric measure for ratio of speed of earth to the speed of light
= 1: 3*C^2/(2*pi)^2
= 1: 3*365.242^2/(2*pi)^2
=10,132

Dia. 11.1



References

The following references were located at Wikipedia en.**wikipedia**.org/w/index.php

1.Forth Coordinate- Wikipedia - In modern physics, space and time, are unified in a four-dimensional Minkowski continuum called space-time, whose metric treats the time dimension differently from the three spatial dimensions. In classical, non-relativistic physics it is a scalar quantity and, like length, mass and charge, is usually described as a fundamental quantity. Time can be combined mathematically with other physical quantities to derive other concepts such as motion, kinetic energy and time-dependent fields.

Orbital parameters

[Astronomical Almanac 2000, p. E3]

2.

Aristarchus of Samos (/ˌærəˈstɑrkəs/; Greek: Ἀρίσταρχος *Aristarkhos*; c. 310 – c. 230 BC) was an ancient Greek astronomer and mathematician who presented the first known model that placed the Sun at the center of the known universe with the Earth revolving around it (see Solar system). He was influenced by Philolaus of Croton, but he identified the "central fire" with the Sun, and put the other planets in their correct order of distance around the Sun.[1] As Anaxagoras before him, he also suspected that the stars were just other bodies like the sun. His astronomical ideas were often rejected in favor of the geocentric theories of Aristotle and Ptolemy.

3.

In the Ptolemaic system, each planet is moved by a system of two spheres: one called its deferent, the other, its epicycle. The deferent is a circle whose center point, called the eccentric and marked in the diagram with an X, is removed from the Earth. The original purpose of the eccentric was to account for the differences of the lengths of the seasons (autumn is the shortest by a week or so), by placing the Earth away from the center of rotation of the rest of the universe. Another sphere, the epicycle, is embedded inside the deferent sphere and is represented by the smaller dotted line to the right. A given planet then moves around the epicycle at the same time the epicycle moves along the path marked by the deferent. These combined movements cause the given planet to move closer to and further away from the Earth at different points in its orbit, and explained the observation that planets slowed down, stopped, and moved backward in retrograde motion, and then again reversed to resume normal, or prograde, motion.

4.

Senenmut (sometimes spelled **Senmut**, **Senemut**, or **Senmout**) was an 18th dynasty ancient Egyptian architect and government official. His name translates literally as "mother's brother."[1]

5. **Plato** (/ˈpleɪtoʊ/;[1] Greek: Πλάτων *Plátōn* pronounced [plá.tɔːn] in Classical Attic; 428/427 or 424/423 – 348/347 BC) was a philosopher and mathematician in Classical Greece, and the founder of the Academy in Athens, the first institution of higher learning in the Western world. He is widely considered the most pivotal figure in the development of philosophy, especially the Western tradition.[2] Unlike nearly all of his philosophical contemporaries, Plato's entire *œuvre* is believed to have survived intact for over 2,400 years.[3]

6.

Nicolaus Copernicus (/koʊˈpɜrnɪkəs/;[1] Polish: *Mikołaj Kopernik* [miˈkɔwaj kɔˈpɛrɲik] (listen); German: *Nikolaus Kopernikus*; 19 February 1473 – 24 May 1543) was a Renaissance mathematician and astronomer who formulated a model of the universe that placed the Sun rather than the Earth at the center of the universe.[a] The publication of this model in his book *De revolutionibus orbium coelestium* (*On the Revolutions of the Celestial Spheres*) just before his death in 1543 is considered a major event in the history of science, triggering the Copernican Revolution and making an important contribution to the Scientific

Revolution.

7.
Galileo Galilei (Italian pronunciation: [galiˈlɛːo galiˈlɛi]; 15 February 1564[3] – 8 January 1642), was an Italian astronomer, physicist, engineer, philosopher, and mathematician who played a major role in the scientific revolution during the Renaissance. Galileo has been called the "father of observational astronomy",[4] the "father of modern physics",[5][6] and the "father of science".[7] His contributions to observational astronomy include the telescopic confirmation of the phases of Venus, the discovery of the four largest satellites of Jupiter (named the Galilean moons in his honour), and the observation and analysis of sunspots. Galileo also worked in applied science and technology, inventing an improved military compass and other instruments.

8.

Johannes Kepler (German: [ˈkɛplɐ]; December 27, 1571 – November 15, 1630) was a German mathematician, astronomer, and astrologer. A key figure in the 17th century scientific revolution, he is best known for his laws of planetary motion, based on his works *Astronomia nova*, *Harmonices Mundi*, and *Epitome of Copernican Astronomy*. These works also provided one of the foundations for Isaac Newton's theory of universal gravitation.