"SYMMETRIES OF THE PLATONIC TRIANGLES"

By:

Eur Ing *Panagiotis Chr. Stefanides*

BSc(Eng)Lon(Hons) MSc(Eng)NTUA TEE CEng MIET

IET HELLAS

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“SYMMETRIES OF THE PLATONIC TRIANGLES”

I was born in the city of Aegaleo, Athens, in 1945 and grew up in the port of Piraeus.
My basic, high school education in Greece, at the Lyceum of Plato, was mainly in Classics including Arts and Languages, and my London and Athens University studies in Engineering, included a big content of Mathematics.
By my continuous contact, with Engineering and Scientific knowledge, in subjects concerning motion, forces, energy, power etc., I noticed, that, there exist seven (7) basic forms, which appear to derive one from the other and thus related. These forms (relationships) necessary for the creation of a (powerful) work element, from its conceptual idea to materialization are Line, surface, volume per unit time* (mass rate*of unity water density), momentum, force, work (or energy) and power. They are fractions with numerators powers of space (length) and denominators powers of time:
L^1/T^0, L^2/T^0 , L^3/T^1, L^4/T^1, L^4/T^2, L^5/T^2, L^5/T^3.
Length (L^1/T^0) and Surface (L^2/T^0) Ratios are Timeless, Encephalic Concepts, as T^0=1.

Contemplating our Cosmos with its Spiral Galaxies, I seeked further the Greek Philosophers their Classical Mathematical concepts, and the Culture and Art of the Greek antiquity.
I will refer here to contents of various sources which are related to the Greek Culture, Art, and, and Geometry. In Encyclopaedia Britannica (Vol. 10, 1972, page 829, Greek Architecture) it is stated:
“To the Greeks fell the role of inventing the grammar of conventional forms on which all subsequent European Architecture was based...
……Greek was the patient genius, with which perfected every element, rarely deviating from the forward path to invent new forms or new solutions of old problem... This conservative adherence to older types led to such masterpieces as the Parthenon and Erechtheum.

According to THEOPHANIS MANIAS
[3, 4], the Greek Beauty and the Greek Spirit found in many works of Antiquity, were not ruined by time, death of people or peoples', fanatism and mania. Cities and Sacred Temples were founded according to plans and scientific computations.

Religion of the Ancients was the Absolute Beauty, and the Greeks believed as God this Absolute Beauty. Aesthetic Beauty, Optical Beauty, in forms and colours, and Acoustic Beauty in music, Ethic Beauty, found in virtue, and Spiritual Beauty in good learning and knowledge Man sensed, and conquered, all kinds of Beauty, through Love, because Love is the Synectic Substance of the Harmonic Universe.

The Ancients had studied this subject, with religious piety. They had observed the existence, of another Beauty, in Nature.

Beyond this Harmony, which is Visible, and used, today, by architects, decorators, and generally all those occupied with Aesthetics and Arts, there is another Invisible Geometric Harmony. Circle, Square, Equilateral Triangle, Regular Hexagon, Cube, Pyramids etc., have a Visible Beauty that man senses by his eyes and he finds it in these geometric forms. Symmetries, analogies and other mathematical relationships, were found in the leaves of trees, the petals of flowers, the trunks and branches of plants, the bodies of animals and most important, the human body, which composed an Invisible Harmony, of forms and colours superior than the Visible Harmony. This Invisible Harmony, we find, in all expressions of the Hellenic Civilization.

EVAGELOS STAMATIS (Hellenic Mathematics No. 4 Sec. Ed. 1979), states that THEOPHANIS MANIAS, discovered that the Ancient Sacred Temples of the Hellenic Antiquity, were founded according to Geometrical Computations and measurements.

In the distances, between these Sacred Locations, THEOPHANIS MANIAS, observes, application of, the Golden Section. EVAGELOS STAMATIS, also, states that the German Intellectual MAX STECK, Professor of the University of Munich, in his article, which he published in the Research and Progress Magazine, supports that the Western Civilization, Arts, Crafts and Sciences, derive from the influence of the Greek mathematics.

The sources that we get knowledge from, about the Greek Mathematics, are the archaeological researches and the literature of the works of the ancient writers.

MATILA GHYKA [1,2], in his books, presents widely, the Golden Section and Geometry in relation to painting, sculpture, architecture of human faces and bodies, as well as bodies of animals, plants, and shells, in relation to logarithmic spiral.

ROBERT LAWLOR [5],similarly, elaborates on these subjects, and additionally, he states, that, the Egyptians, while building the Pyramid, used the ratio 4/SQR[Phi] , for the value of Pi (ratio of the circumference of a circle by its diameter).

MAX TOTH (Pyramid Prophesies Edition 1988), correspondingly, refers to this ratio, as a useful, approximate form. He also states that, the Mathematicians, from HERODOTUS, have modelled an Orthogonal Triangle, whose small perpendicular, is equal to Unity, the bigger one is equal to SQRT(Phi), and its hypotenuse, is equal to Phi [i.e. GOLDEN NUMBER]. Also,

KEPLER refers to the same, triangle (of MAGIRUS) in a letter to his former professor Michael Mastlin- according to Professor Roger Herz- Fischler [8].

**Personally while building a conceptual heliotropic machine [Figure 1], a Solar Tracking contrivance for energy, I found GOLDEN RATIO approximate relationship of the maximum azimuthal angle of the Sun day in degrees is 222..[max. day hours14.8H], with respect to 360 Deg., around the 38th Parallel, Athens [21 June Greece Sun Rise 05:03 –Sun Set 19:51, Dif. =14H: 48First = 14.8H, ratio 24H/14.8H=1.62..]
Ratio 360/222..=1.62..**

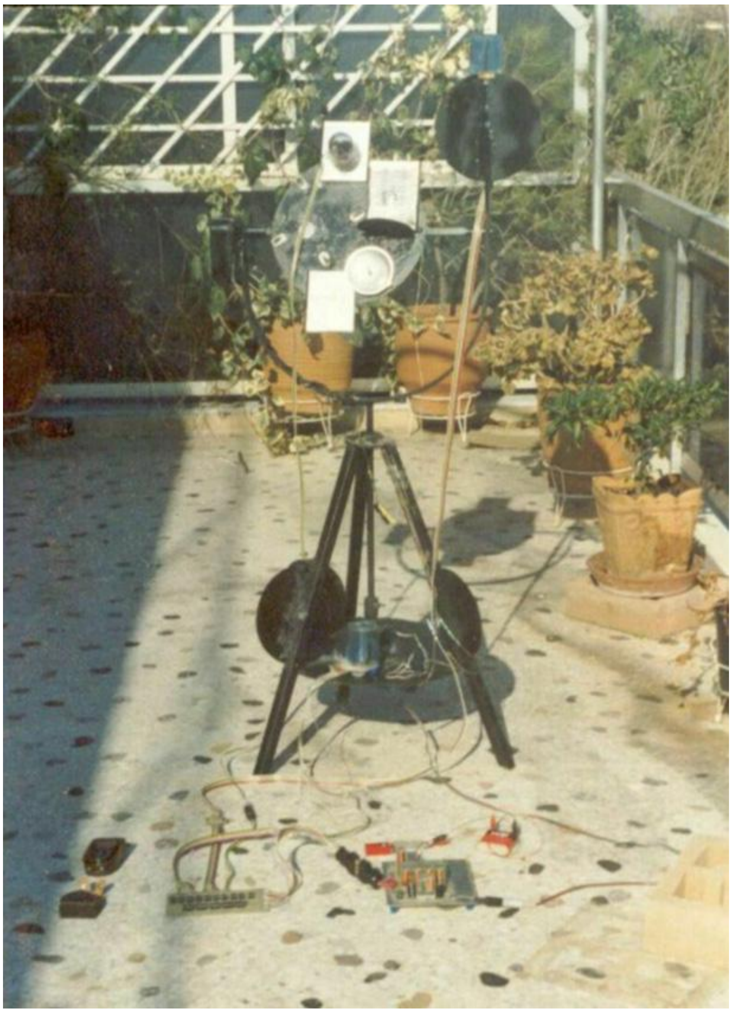


Figure 1

With all above, in mind I searched further the subject related to the PYTHAGOREAN THEORY, and particularly the PLATONIC TIMAEUS, which gave me the chance to approach THE GOLDEN RATIO, and its SQUARE ROOT.

In section 53, of PLATO'S "TIMAEUS", PLATO speaks about the shapes of the FOUR SOLIDS, of their kinds and their combinations. These are Fire (Tetrahedron) Earth (Cube), Water (Icosahedron), and Air (Octahedron). They are bodies and have depth. The depth necessarily, contains the flat surface and the perpendicular to this surface is a side of a triangle and all the triangles are generated by two kinds of Orthogonal Triangles

the "ISOSCELES" and the "SCALENE".

From the two kinds of triangles the "Isosceles" Orthogonal has one nature. (i.e. one rectangular angle and two acute angles of 45 degrees), whereas the "Scalene" has infinite (i.e. it has one rectangular angle and two acute angles of variable values having, these two acute angles, the sum of 90 degrees).

From these infinite natures we choose one triangle "THE MOST BEAUTIFUL".
Thus, from the many triangles, we accept one of them as "THE MOST BEAUTIFUL",
and we leave those by which the equilateral triangle is constructed (i.e. by using six "scalene" orthogonal triangles, having 30 and 60 degrees their acute angles).
The "SCALENE" orthogonal triangle, has its hypotenuse
[Stefanides Interpretation] equal to the "CUBE" [T^3], of the value of its horizontal smaller side [T^1] and
its vertical bigger side the value of the
"SQUARE" [T^2] of its smaller horizontal side.
Thus, by the Pythagorean Theorem:

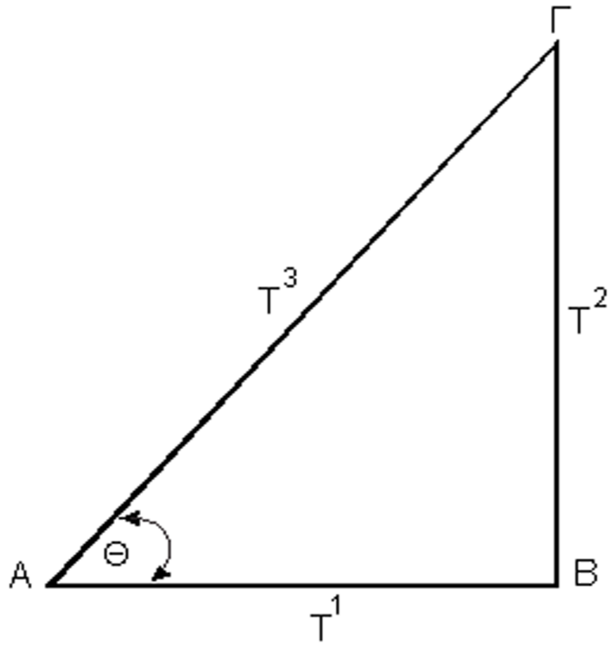
[T^3]^2 =[T^2]^2 + [T^1]^2 or

T^6=T^4+T^2 or

T^4 - T^2 - 1 = 0

[Figure 2 ,
the proposed Most Beautiful Orthogonal Triangle, and

Figure 3,
its current configuration by publications and elaboration on its interpretation].



$$T^4 - T^2 - 1 = 0$$

$$T^6 - T^4 - T^2 = 0$$

$$T^6 = T^4 + T^2$$

$$(T^3)^2 = (T^2)^2 + (T^1)^2$$

$$(A\Gamma)(AB) = (\Gamma B)^2$$

$$\mathrm{TAN}\ \Theta = \frac{T^2}{T^1} = T$$

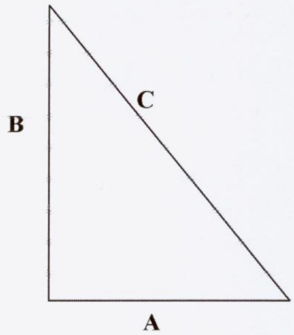
$$\Theta = \mathrm{TAN}^{-1}(T)$$

$$\frac{A\Gamma}{\Gamma B} = \frac{\Gamma B}{BA} = T$$

Figure 2

B^2 = 3A^2

B^2 , THE BIG VERTICAL SIDE “SQUARED” IS THREE TIMES THE SQUARE OF THE SMALL



C = 2A

C IS HYPOTENUSE OF THE ORTHOGONAL 30/60 DEGREES TRIANGLE

C^2 - A^2 = B^2
4A^2 – A^2 = 3A^2

THIS IS THE CURRENT INTERPRETATION OF THE ORIGINAL CLASSICAL GREEK TEXT

A

A IS THE SMALL HORIZONTAL SIDE LENGTH

HOWEVER , THE GREEK TEXT DOES NOT “<u>DIRECTLY</u>” STATE <u>THE “SQUARE” OF THE SIDE</u> , IT STATES “THE SIDE IS THREE TIMES THE SQUARE ” IF THIS IS THE CORRECT INTERPRITATION OF :
“...ΤΡΙΠΛΗΝ ΚΑΤΑ ΔΥΝΑΜΙΝ ΕΧΟΝ ΤΗΣ ΕΛΑΤΤΟΝΟΣ ΤΗΝ ΜΕΙΖΩ ΠΛΕΥΡΑΝ ΑΕΙ”
<u>IT SHOULD HAVE STATED</u> :
“...ΤΡΙΠΛΗΝ ΚΑΤΑ ΔΥΝΑΜΙΝ ΕΧΟΝ ΤΗΣ ΕΛΑΤΤΟΝΟΣ ΤΗΝ ΜΕΙΖΩ ΠΛΕΥΡΑΝ <u>*ΚΑΤΑ ΔΥΝΑΜΙΝ*</u> ΑΕΙ”

<u>THE PROPOSED INTERPRETATION IS :</u>
THE CUBE OF THE SMALL HORIZONTAL SIDE IS THE HYPOTENUSE OF THE TRIANGLE AND THE BIG VERTICAL IS THE SQUARE OF THE SMALL.
SO FOR A =T THEN B=T^2 AND C=T^3
THE RATIO OF EACH OF THE SIDES TO ITS NEXT IS :
T^3 / T^2 = T^2/T^1 = T , AND THE FOLLOWING EQUATION HOLDS :
T^4 – T^2 –1 = 0 for which T is The GOLDEN ROOT,or the SQUARE ROOT OF THE GOLDEN SECTION.

Figure 3

The value of the smaller horizontal side [T] is equal to the SQUARE ROOT of the GOLDEN RATIO, the ratio of the consecutive sides is equal, again, to the SQUARE ROOT of the GOLDEN RATIO [geometrical ratio] and the Tangent of the angle between the hypotenuse and the smaller horizontal side is also equal to the SQUARE ROOT of the GOLDEN RATIO (Θ=51Deg. 49 first 38 sec. 15third ….]. The product of the smaller horizontal side and that of the hypotenuse is equal to the "SQUARE" of the bigger vertical side, of this triangle, and at the same time the "PYTHAGOREAN THEOREM" is valid.

The values of the sides of this triangle are given by surd numbers, (solution of a fourth degree equation). Reorganizing this triangle, we get another one with the same angle values, which has its bigger vertical side equal to FOUR (4), its smaller horizontal side equal to FOUR divided by the SQUARE ROOT of the GOLDEN RATIO, and its hypotenuse equal to FOUR multiplied by the SQUARE ROOT of the GOLDEN RATIO [the complement of the angle Θ is [90- Θ] =38 Deg. 10 first 21 sec. 44 third….].

**Further relating PLATOS, TIMAEUS [Pl. Ti 54] where Plato refers to the "MOST BEAUTIFUL TRIANGLE" and that of the SOMATOIDES [Pl. Ti. 31 and 32- stating that "whatever is Born must be Visible Tangible and Bodily"] where the Four Elements are BOUND TOGETHER to become UNITY by the MOST BEAUTIFUL-STEREOID-BOND [which most perfectly unites into one both itself and the things which it binds together, and to effect this in the Most BEAUTIFUL manner is the natural property of PROPORTIONS (ratios)], analysing these ratios:
FIRE : AIR = AIR : WATER and AIR : WATER = WATER : EARTH and thus FIRE : AIR = AIR: WATER = WATER: EARTH and CONFIGURING them [Stefanides] as TWO PAIRS OF ORTHOGONAL SCALENE TRIANGULAR SURFACES [one pair of orthogonal triangles each with sides T^3 , T^2 , T^1 , and the other pair with sides T^2, T^1 and 1 , i.e. four triangular surfaces] BOUND together IN SPACE on a system of three Orthogonal Cartesian Axes of reference [X,Y,Z,], we construct a SOLID [Figure 4], the SOMATOIDES [STEREOID BOND], with coordinates:
[0,0,0],[0,0,T^2], [T,0,0] ,[0,1/T, 1/T^2].**

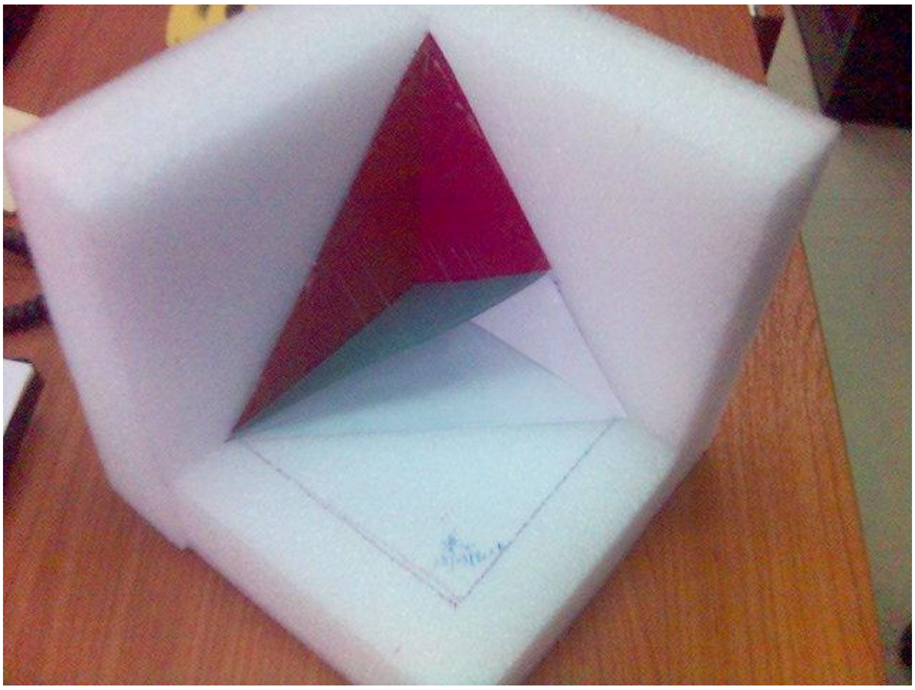


Figure 4

This SOLID, with its COMPLEMENT [which is a SOLID too], have a Skeleton Structure of TWO PERPENDICULAR, to each other, ORTHOGONAL TRIANGLES ,the ISOSCELES,and the MOST BEAUTIFUL, and constitute together 1/8 th of the Great Pyramid Model. [G.P. Model].
The SOMATOIDES to its COMPLEMENT is by VOLUME in GOLDEN RATIO as their sum is to the SOMATOIDES
[a third Wedge Shaped SOLID complements the first two, to form ¼ G.P. Model].
On the basis of the fourth order equation, above [T^4 - T^2 - 1 = 0], the COMPASS and RULER GOLDEN ROOT is drawn here
assuming the knowledge of drawing, as such, the
GOLDEN SECTION [Phi]=[T^2].
[Figure 5 , Geometric Mean Ratio (T) by Ruler and Compass]

http://www.stefanides.gr/gmr.htm

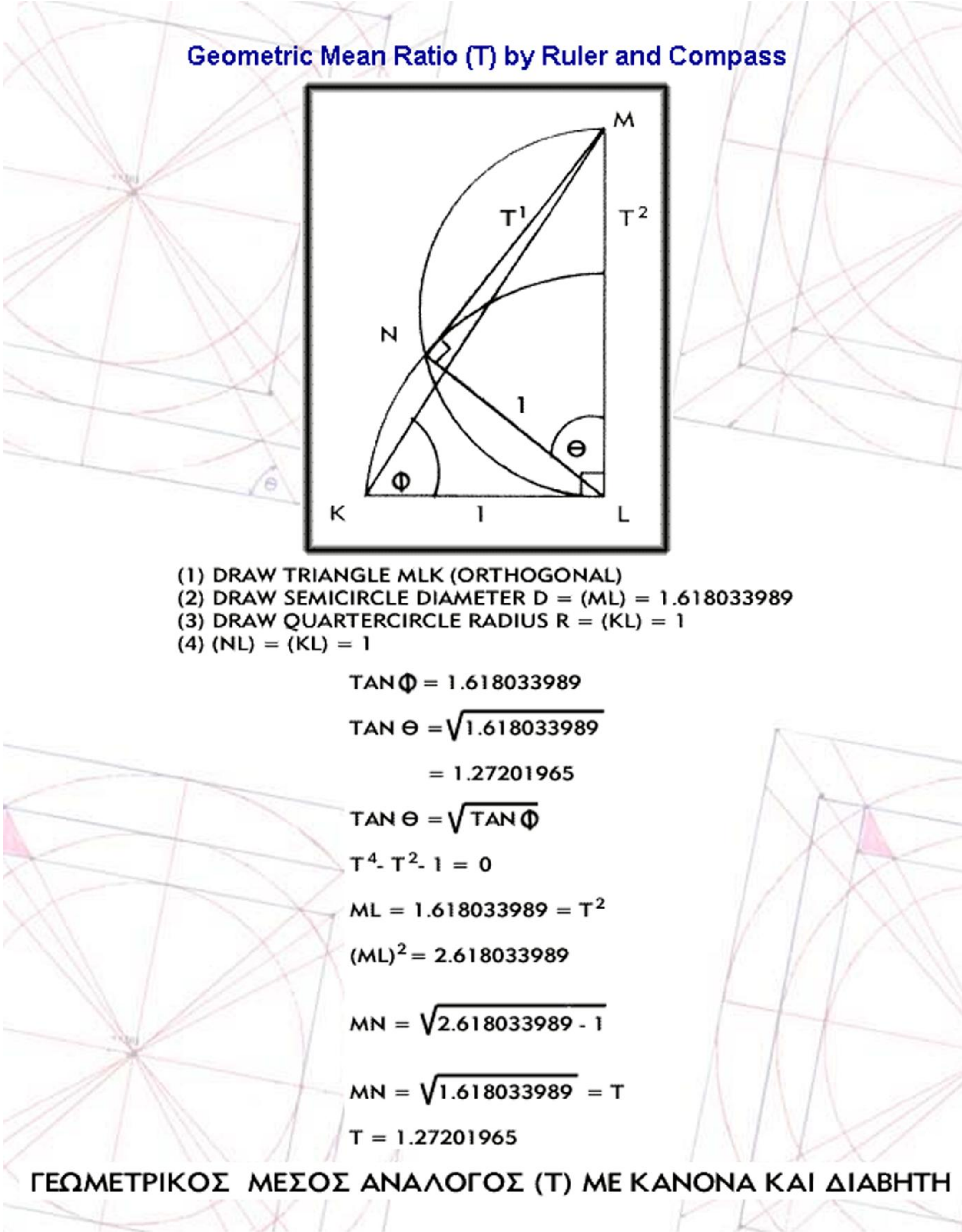

Geometric Mean Ratio (T) by Ruler and Compass
M
T^1
T^2
N
1
Θ
Φ
K
1
L
(1) DRAW TRIANGLE MLK (ORTHOGONAL)
(2) DRAW SEMICIRCLE DIAMETER D = (ML) = 1.618033989
(3) DRAW QUARTERCIRCLE RADIUS R = (KL) = 1
(4) (NL) = (KL) = 1
$\mathrm{TAN}\,\Phi = 1.618033989$
$\mathrm{TAN}\,\Theta = \sqrt{1.618033989}$
$= 1.27201965$
$\mathrm{TAN}\,\Theta = \sqrt{\mathrm{TAN}\,\Phi}$
$T^4 - T^2 - 1 = 0$
$ML = 1.618033989 = T^2$
$(ML)^2 = 2.618033989$
$MN = \sqrt{2.618033989 - 1}$
$MN = \sqrt{1.618033989} = T$
$T = 1.27201965$
ΓΕΩΜΕΤΡΙΚΟΣ ΜΕΣΟΣ ΑΝΑΛΟΓΟΣ (Τ) ΜΕ ΚΑΝΟΝΑ ΚΑΙ ΔΙΑΒΗΤΗ

Figure 5

Relating this triangle with circles squares and parallelograms we get Geometric relationships
[*Figure 6* and *Figure 7*]
http://www.stefanides.gr/quadrature.htm
http://www.stefanides.gr/corollary.htm

and *Figure 8* and *Figure 9* involving quadratures,
http://www.stefanides.gr/piquad.htm , http://www.stefanides.gr/quadcirc.htm

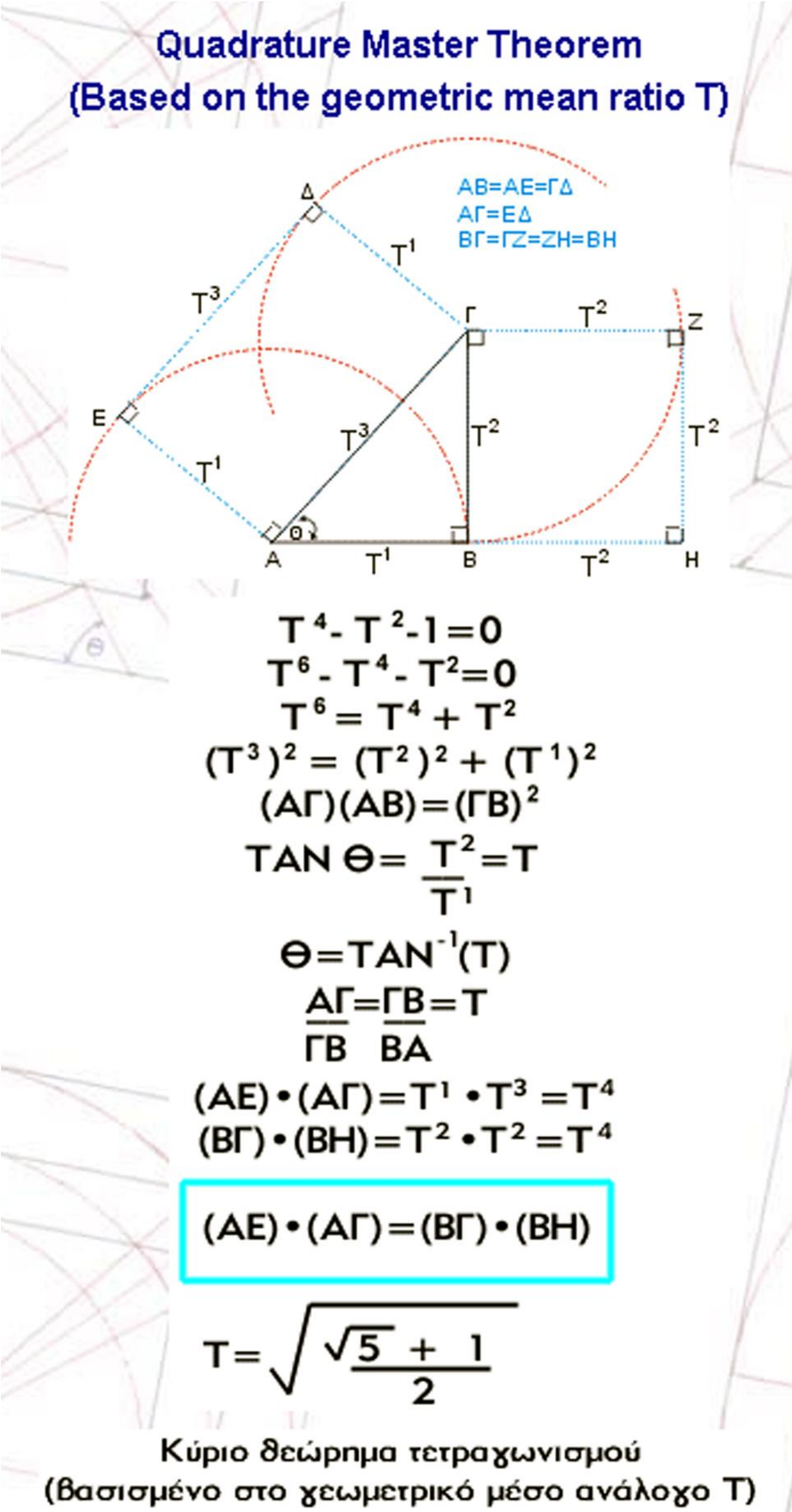

Quadrature Master Theorem
(Based on the geometric mean ratio T)
AB=AE=ΓΔ
AΓ=EΔ
BΓ=ΓZ=ZH=BH
Δ
Γ
Z
E
A
B
H
θ
T^1
T^2
T^3
$T^4 - T^2 - 1 = 0$
$T^6 - T^4 - T^2 = 0$
$T^6 = T^4 + T^2$
$(T^3)^2 = (T^2)^2 + (T^1)^2$
$(A\Gamma)(AB) = (\Gamma B)^2$
$\mathrm{TAN}\,\Theta = \frac{T^2}{T^1} = T$
$\Theta = \mathrm{TAN}^{-1}(T)$
$\frac{A\Gamma}{\Gamma B} = \frac{\Gamma B}{BA} = T$
$(AE) \bullet (A\Gamma) = T^1 \bullet T^3 = T^4$
$(B\Gamma) \bullet (BH) = T^2 \bullet T^2 = T^4$
$\boxed{(AE) \bullet (A\Gamma) = (B\Gamma) \bullet (BH)}$
$T = \sqrt{\frac{\sqrt{5} + 1}{2}}$
Κύριο θεώρημα τετραγωνισμού
(βασισμένο στο γεωμετρικό μέσο ανάλογο T)

Figure 6

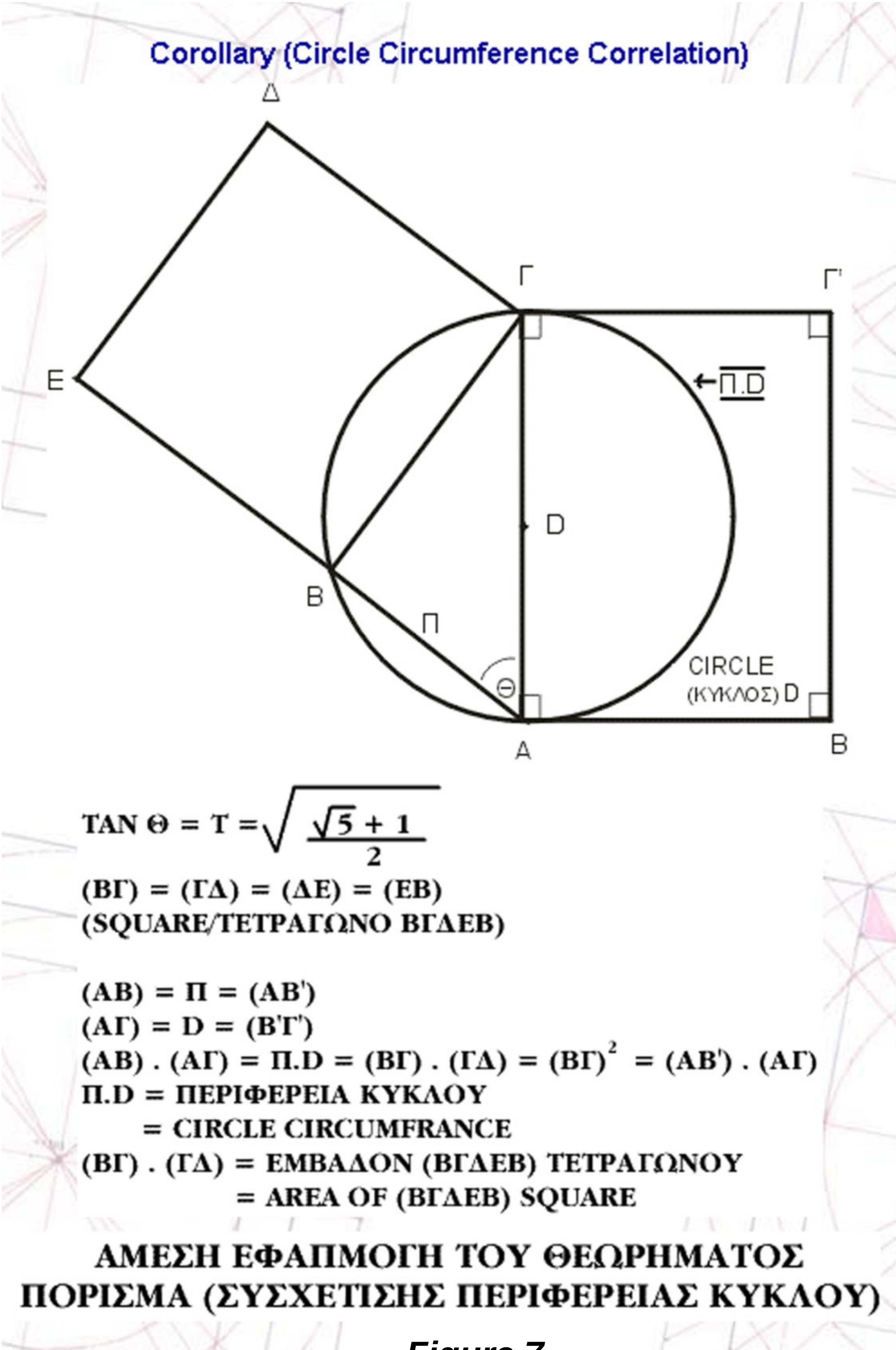

Corollary (Circle Circumference Correlation)
Δ
Γ
Γ'
E
←Π.D
D
B
Π
Θ
CIRCLE
(ΚΥΚΛΟΣ) D
A
B
TAN Θ = T = $\sqrt{\frac{\sqrt{5}+1}{2}}$
(ΒΓ) = (ΓΔ) = (ΔΕ) = (ΕΒ)
(SQUARE/ΤΕΤΡΑΓΩΝΟ ΒΓΔΕΒ)
(ΑΒ) = Π = (ΑΒ')
(ΑΓ) = D = (Β'Γ')
(ΑΒ) . (ΑΓ) = Π.D = (ΒΓ) . (ΓΔ) = $(\text{ΒΓ})^2$ = (ΑΒ') . (ΑΓ)
Π.D = ΠΕΡΙΦΕΡΕΙΑ ΚΥΚΛΟΥ
= CIRCLE CIRCUMFRANCE
(ΒΓ) . (ΓΔ) = ΕΜΒΑΔΟΝ (ΒΓΔΕΒ) ΤΕΤΡΑΓΩΝΟΥ
= AREA OF (ΒΓΔΕΒ) SQUARE
ΑΜΕΣΗ ΕΦΑΠΜΟΓΗ ΤΟΥ ΘΕΩΡΗΜΑΤΟΣ
ΠΟΡΙΣΜΑ (ΣΥΣΧΕΤΙΣΗΣ ΠΕΡΙΦΕΡΕΙΑΣ ΚΥΚΛΟΥ)

Figure 7

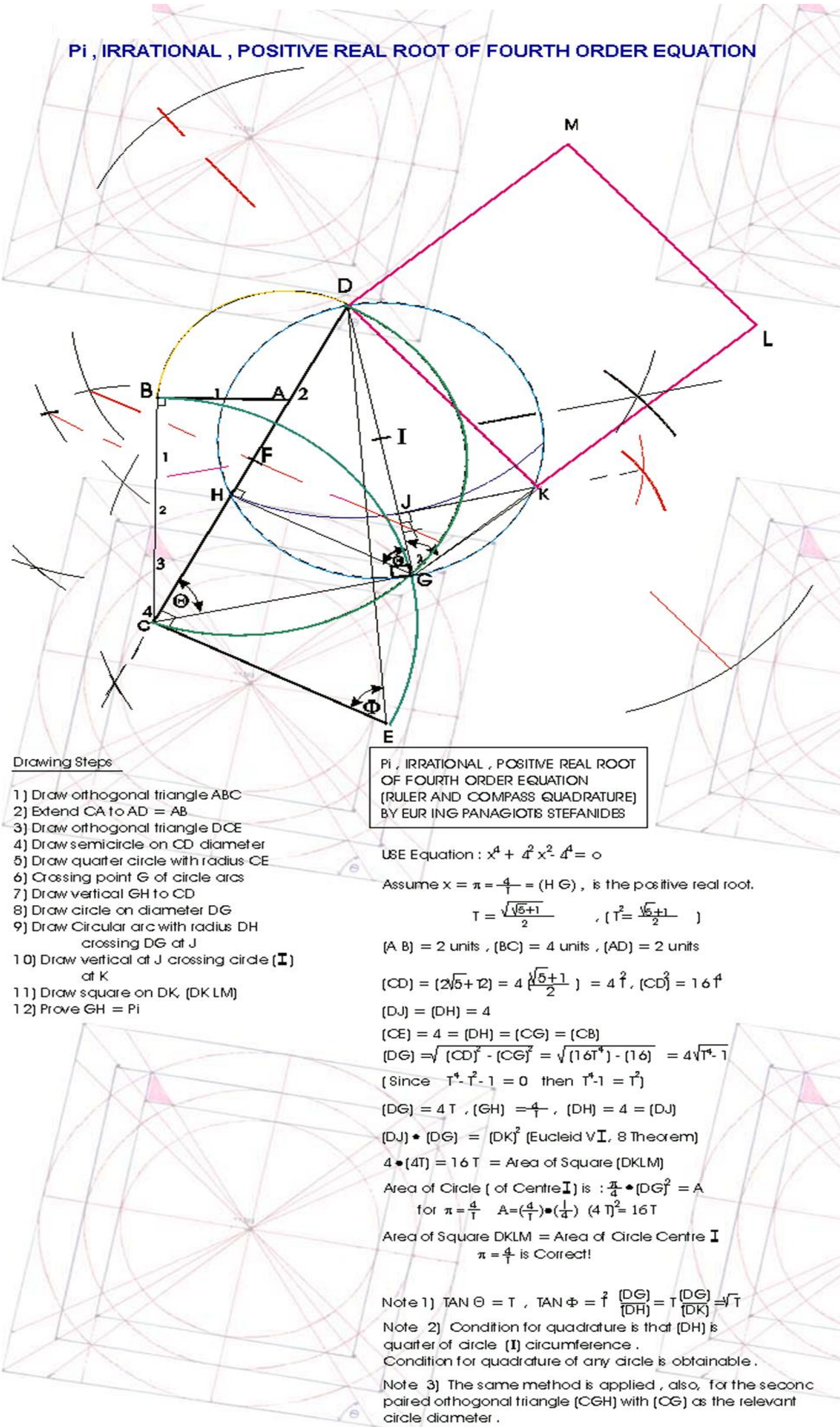
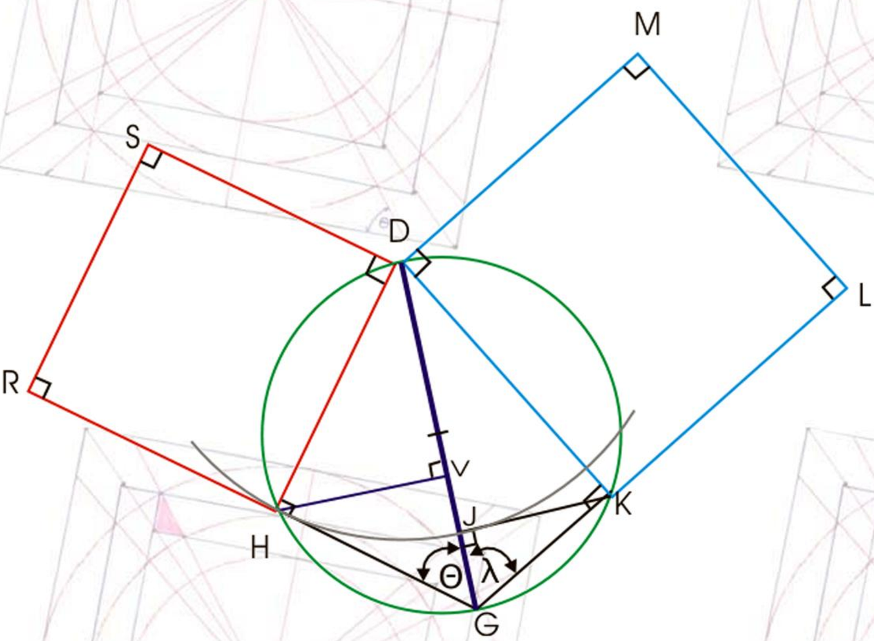

Pi , IRRATIONAL , POSITIVE REAL ROOT OF FOURTH ORDER EQUATION
M
D
L
B
A
F
I
H
J
K
G
C
E
Θ
Φ
Drawing Steps
1) Draw orthogonal triangle ABC
2) Extend CA to AD = AB
3) Draw orthogonal triangle DCE
4) Draw semicircle on CD diameter
5) Draw quarter circle with radius CE
6) Crossing point G of circle arcs
7) Draw vertical GH to CD
8) Draw circle on diameter DG
9) Draw Circular arc with radius DH crossing DG at J
10) Draw vertical at J crossing circle (I) at K
11) Draw square on DK, (DKLM)
12) Prove GH = Pi
Pi , IRRATIONAL , POSITIVE REAL ROOT OF FOURTH ORDER EQUATION (RULER AND COMPASS QUADRATURE) BY EUR ING PANAGIOTIS STEFANIDES
USE Equation : $x^4 + 4^2 x^2 - 4^4 = 0$
Assume $x = \pi = \frac{4}{T} = (HG)$, is the positive real root.
$T = \frac{\sqrt{\sqrt{5}+1}}{2}$, ($T^2 = \frac{\sqrt{5}+1}{2}$)
(A B) = 2 units , (BC) = 4 units , (AD) = 2 units
$(CD) = (2\sqrt{5}+2) = 4\left(\frac{\sqrt{5}+1}{2}\right) = 4T^2$, $(CD)^2 = 16T^4$
(DJ) = (DH) = 4
(CE) = 4 = (DH) = (CG) = (CB)
$(DG) = \sqrt{(CD)^2 - (CG)^2} = \sqrt{(16T^4) - (16)} = 4\sqrt{T^4 - 1}$
(Since $T^4 - T^2 - 1 = 0$ then $T^4 - 1 = T^2$)
$(DG) = 4T$, $(GH) = \frac{4}{T}$, $(DH) = 4 = (DJ)$
$(DJ) \bullet (DG) = (DK)^2$ (Eucleid VI, 8 Theorem)
$4 \bullet (4T) = 16T$ = Area of Square (DKLM)
Area of Circle (of Centre I) is : $\frac{\pi}{4} \bullet (DG)^2 = A$
for $\pi = \frac{4}{T}$ $A = \left(\frac{4}{T}\right) \bullet \left(\frac{1}{4}\right) (4T)^2 = 16T$
Area of Square DKLM = Area of Circle Centre I
$\pi = \frac{4}{T}$ is Correct!
Note 1) $\tan\Theta = T$, $\tan\Phi = T^2$ $\frac{(DG)}{(DH)} = T \frac{(DG)}{(DK)} = \sqrt{T}$
Note 2) Condition for quadrature is that (DH) is quarter of circle (I) circumference .
Condition for quadrature of any circle is obtainable .
Note 3) The same method is applied , also, for the seconc paired orthogonal triangle (CGH) with (CG) as the relevant circle diameter .

Figure 8

QUADRATURE OF CIRCLE , THEORETICAL DEFINITION

For any circle , if a chord , such as (DH) is a quarter of the circles circumference, then the square , such as (DKLM) has an area equal to that of the circle, and perimeter of square (DHRS) equal to the circumference of the circle.



d=(DG)=Diameter

$\sin(\Theta)=\frac{\pi}{4}$

$(DH)=(\frac{\pi * d}{4})=(DJ)$

$\sin(\lambda)=\sqrt{\frac{\pi}{4}}$

$(DK)^2=(\frac{\pi * d}{4})(d)=(DJ)(DG)$ eucleid VI , 8 : $(DV)(DG) = (DH)^2$

$(DK)^2=(\frac{\pi * d^2}{4})$ i.e. Area of square = Area of circle

2.For one particular circle , in addition to the above theorem (1) , for

$\tan \Theta = T = \sqrt{\frac{\sqrt{5}+1}{2}}$,

$(DV)=(HG)$ and , $(HG) * (GD) = (DH)^2 = (\frac{\pi * d}{4})^2 = \pi * d$, if (HG) is π , then :

$(\frac{\pi * d}{4})^2 = \frac{\pi^2 * d^2}{16} = \pi * d$, or $(\pi * d) = 16$, $d = \frac{16}{\pi}$ and $(\frac{\pi * d}{4}) = (\frac{\pi}{4})(\frac{16}{\pi}) = 4$

Using Pythagoras on triangle GHD , we get

$(\frac{16}{\pi})^2 = \pi^2 + 4^2$, or , $\pi^4 + 4^2\pi^2 - 4^4 = 0$, for which the positive, real root for π $= \frac{4}{T}$ and so $\sin(\Theta) = \frac{1}{T}$ and $\sin(\lambda) = \sqrt{\frac{1}{T}}$ for quadrature .

Figure 9

and relationships with logarithms and spirals

[*Figure 10, NAUTILUS LOG (T) BASE SHELL CURVE* <u>*relating the referred triangle with the curve ,*</u>

Figure 11, the mollusk NAUTILUS shell,

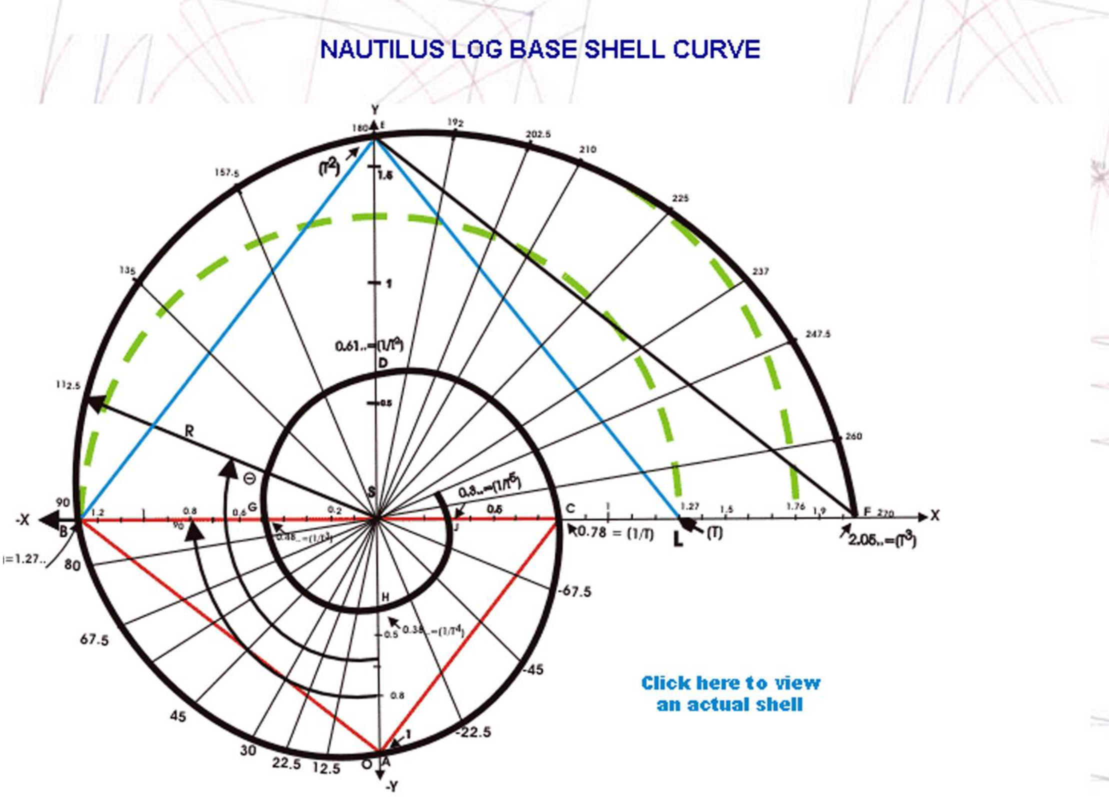
***Figure 12, WHY LOGARITHM . X/Y Plane ,Polar Plots of " SPIRALOGARITHMS " to various Logarithmic Bases, With mathematics in Figure 13,* and**

***Figure 14 , X/Y Plane , X/LogX Plots to various Logarithmic Bases*].**

http://www.stefanides.gr/nautilus.htm

http://www.stefanides.gr/why_logarithm.htm

[The curve points of the spirals may be obtained graphically by compass and ruler, since expressions of series containing powers may be obtained graphically, step by step, making use of the orthogonal triangle property of multiplying all of its sides by the same length].



NAUTILUS LOG BASE $\sqrt{\Phi}$ SHELL CURVE
COPYRIGHT PANAGIOTIS STEFANIDES SEPT 2001
$T = \sqrt{\Phi} = \sqrt{\frac{\sqrt{5}+1}{2}} = 1.27201965$..........
SET OF X - Y AXES
CURVE CROSSES AXES AT :
$A = 1 \angle 0$ deg
$B = T \angle 90$ deg
$E = T^2 \angle 180$ deg
$F = T^3 \angle 270$ deg

$$\mathrm{Log}(R) = \frac{\Theta}{90}$$

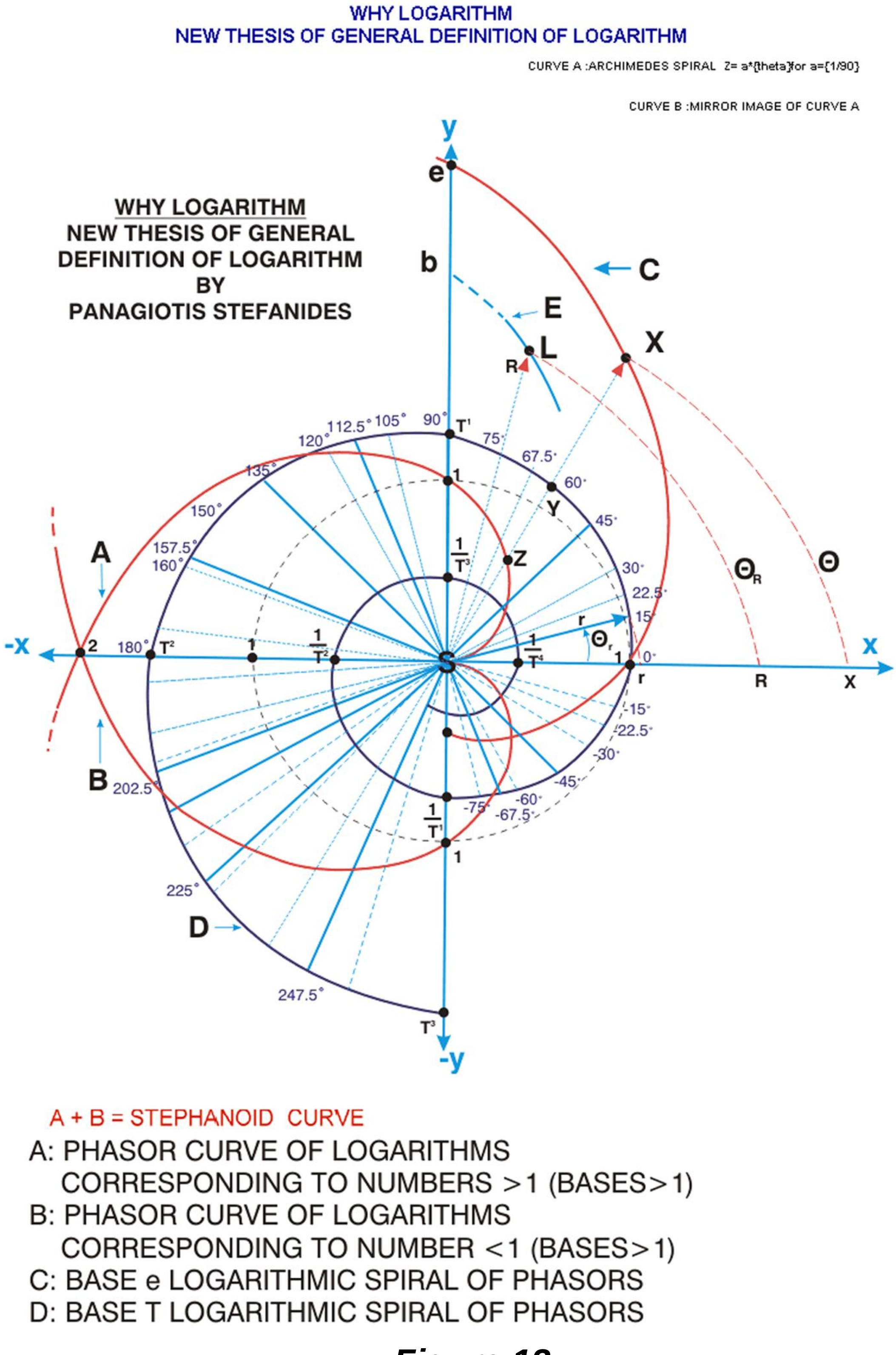
$$\frac{\Theta}{90} = \frac{\Theta\ \mathrm{rad}}{(\frac{\pi}{2})\ \mathrm{rad}} = \frac{(\frac{\Theta \pi}{180})}{(\frac{\pi}{2})}$$

VECTOR SB = BASE (T)
AT 90 DEG
CLOCKWISE,
FROM:
VECTOR SA = $1 \angle 0$
R, ANY VECTOR WITH
ANGLE Θ,
CLOCKWISE FROM SA
POSITIVE , AND
ANTICLOCKWISE
NEGATIVE.

1. CURVE, APPROXIMATES, VERY CLOSELY, TO A NAUTILUS SHELL, FROM SYROS ISLAND (HERMOUPOLIS),2001.
2. NAUTILUS SHELL, FITS APPROX. WITHIN C D G H J , WITH DIMENSIONS (FACTOR 10):
   GC= 12.8 CM (THEORETICAL 12.7201965...)
   HD = 10.3 CM (THEORETICAL 10 CM)
3. THEORY FOLLOWS:
   LOGARITHM SPIROID DEFINITION
   http://www.dotcreative.com/stefanides/logarithm.htm
   http://www.stefanides.gr
   panamars@otenet.gr
4. BASE(T), LOG EXAMPLE (R=1.76): LOG(1.76)= $\frac{210}{90}$ =2.333....(THEOR: 2.34...)
5. TRIANGLE ABC HAS SIDES : T^1 , T^2 , T^3 , (PLATOS MOST BEAUTIFUL TRIANGLE, PROPOSED IN CONFERENCES BY P. STEFANIDES)
   TAN [(BCA), ANGLE)] = T (THEORETICAL)
   (BCA) ANGLE = 51 DEG, 49 FIRST, 38 SECOND.......
   (MODEL, GREAT PYRAMID (BEL) SECTION SLOPE)
   Http://www.dotcreative.com/stefanides/platostriangle.htm
   http://www.dotcreative.com/stefanides/plato.htm

Figure10

Nautilus Shell
Figure 11



A: PHASOR CURVE OF LOGARITHMS
CORRESPONDING TO NUMBERS >1 (BASES>1)
B: PHASOR CURVE OF LOGARITHMS
CORRESPONDING TO NUMBER <1 (BASES>1)
C: BASE e LOGARITHMIC SPIRAL OF PHASORS
D: BASE T LOGARITHMIC SPIRAL OF PHASORS

Figure 12

$$T = \sqrt{\frac{\sqrt{5} + 1}{2}}$$

E: BASE b LOGARITHMIC SPIRAL OF PHASORS

(FOR b=1 SPIRAL DEGENERATES TO A CIRCLE OF RADIUS 1)

$$\log_e X = \log_T Y = Z = \frac{\Theta \text{ DEG}}{90 \text{ DEG}}$$

$$X = e^{[\Theta/90]} = 1 + [\Theta/90] + \frac{[\Theta/90]^2}{2!} + \frac{[\Theta/90]^3}{3!} + \ldots$$

$$X = 1 + \log_e X + \frac{[\log_e X]^2}{2!} + \frac{[\log_e X]^3}{3!} + \ldots$$

$$Y = T^{(\log_e X)}$$

$$\log_e Y = \log_e X \bullet \log_e T$$

$$Y = e^{[\log_e X \bullet \log_e T]}$$

$$Y = 1 + [\log_e X \bullet \log_e T] + \frac{[\log_e X \bullet \log_e T]^2}{2!} + \ldots$$

L: POINT ON SPIRAL, E, BASE b, PHASOR R

$$Re^{i\Theta_R} = b^{(\Theta_R/90)} \text{ AND } R^n e^{(in\Theta_R)} = b^{(n\Theta_R/90)}$$

NOTES:

1) **ANY POINT ON THE X-Y PLANE MAY, THUS, BE DEFINED**

2) $Re^{i\Theta_R}$ **IS MULTIVALUED, AND, COMPLEX**

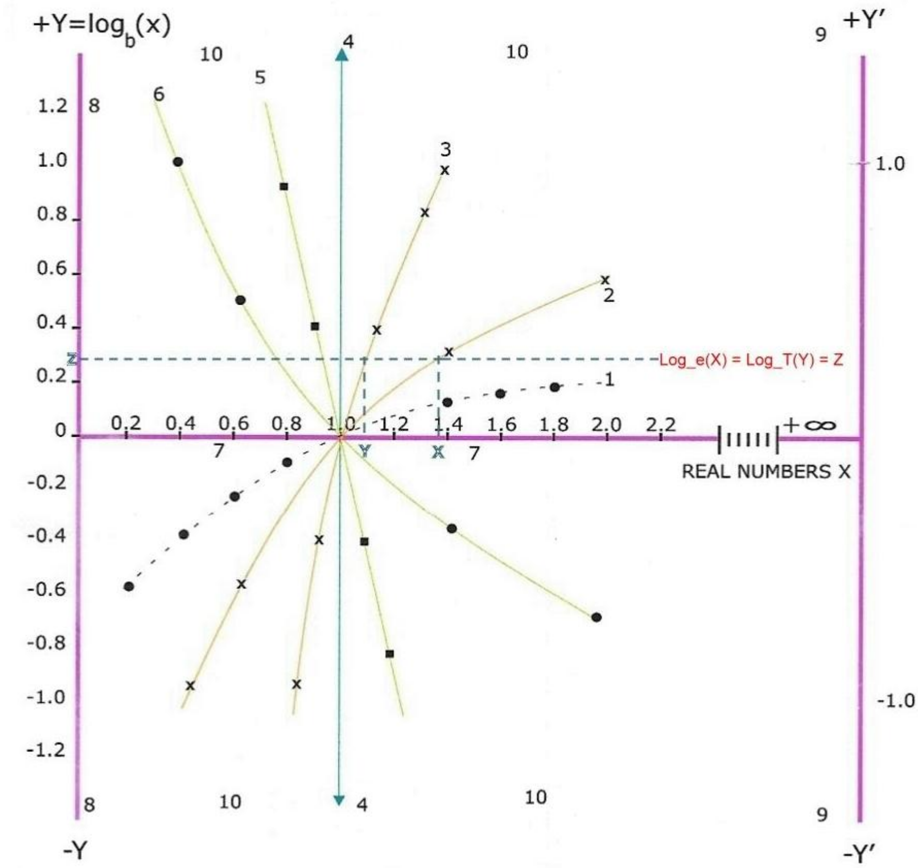
3) $b^{(\Theta_R/90)}$ **IS SINGLE VALUED, AND, REAL!**

4) **Θ IN DEGREES, AND 90, IN DEGREES**

5) **BASES < 1 : HAVE PESITIVE LOGARITHM FOR NUMBERS < 1 AND VICE VERSA.**

6) **X IS A REPRESENTATIVE PHASOR OF Θ DEGREES FROM THE POSITIVE X AXIS, HAVING A LENGTH OF SX, WHICH IS A REAL POSITIVE NUMBER ON THE X AXIS.**

Figure 13



1) $\log_{b1}(x)$, $b1 = 10$

2) $\log_{b2}(x)$, $b2 = e = 2.71828182...$

3) $\log_{b3}(x)$, $b3 = T = 1.27201965...$

SLOPES OF CURVES ARE POSITIVE

4) $\log_{b4}(1) = I$ $b4 = 1$, I = INDETERMINATE WITH VALUES FROM $-\infty$ TO $+\infty$ SLOPE $\pm$ INFINITY.

5) $\log_{b5}(x)$, $b5 = \frac{1}{T} = 0.786151378...$

6) $\log_{b6}(x)$, $b6 = \frac{1}{e} = 0.367879441...$

SLOPES OF CURVES ARE NEGATIVE

7) $\log_{o}(x) = \log_{+\infty}(x) = 0$, FOR $0 < x < +\infty$, X - AXIS (SLOPES ZERO).

8) $\log_{o}(o) = \log_{+\infty}(o) = I$

9) $\log_{+\infty}(+\infty) = \log_{o}(+\infty) = I$

INDETERMINATE WITH VALUES FROM $-\infty$ TO $+\infty$ SLOPES $\pm$ INFINITY (Y AND Y' AXES).

10) $\log_{1}(x) = \pm\infty$ FOR $+\infty \geq x > 1$ OR $O <= X < 1$

N.B.: $b1 > b2 > b3 > b4 > b5 > b6$

Figure 14

By using sections of the four solids, we find the relationships, between them i.e. the Icosahedron with the Octahedron, the Tetrahedron and the Cube. In addition, if we add selective sections [one next to the other], of the three solids, Icosahedron, Octahedron and Tetrahedron, we find an angle [epsilon=41.8103149.Deg.=2*arctan{1/T^4}=arctan{1/sqrt (1.25)}] which we find also in a section of the Dodecahedron.

So, in this manner we obtain a relationship, of the Dodecahedron with the other Four Platonic Solids. Dodecahedron was considered as the FIFTH SOLID, mentioned by PLATO in his Timaeus, which "God used it up to Ornament the World", and was given the name AETHER, by the philosophers.
THE GOLDEN RATIO is found in Section of the Dodecahedron, as also it is found in Section of the Icosahedron, Figure 15, is the section of Icosahedron

http://www.stefanides.gr/icosohadron.htm ,

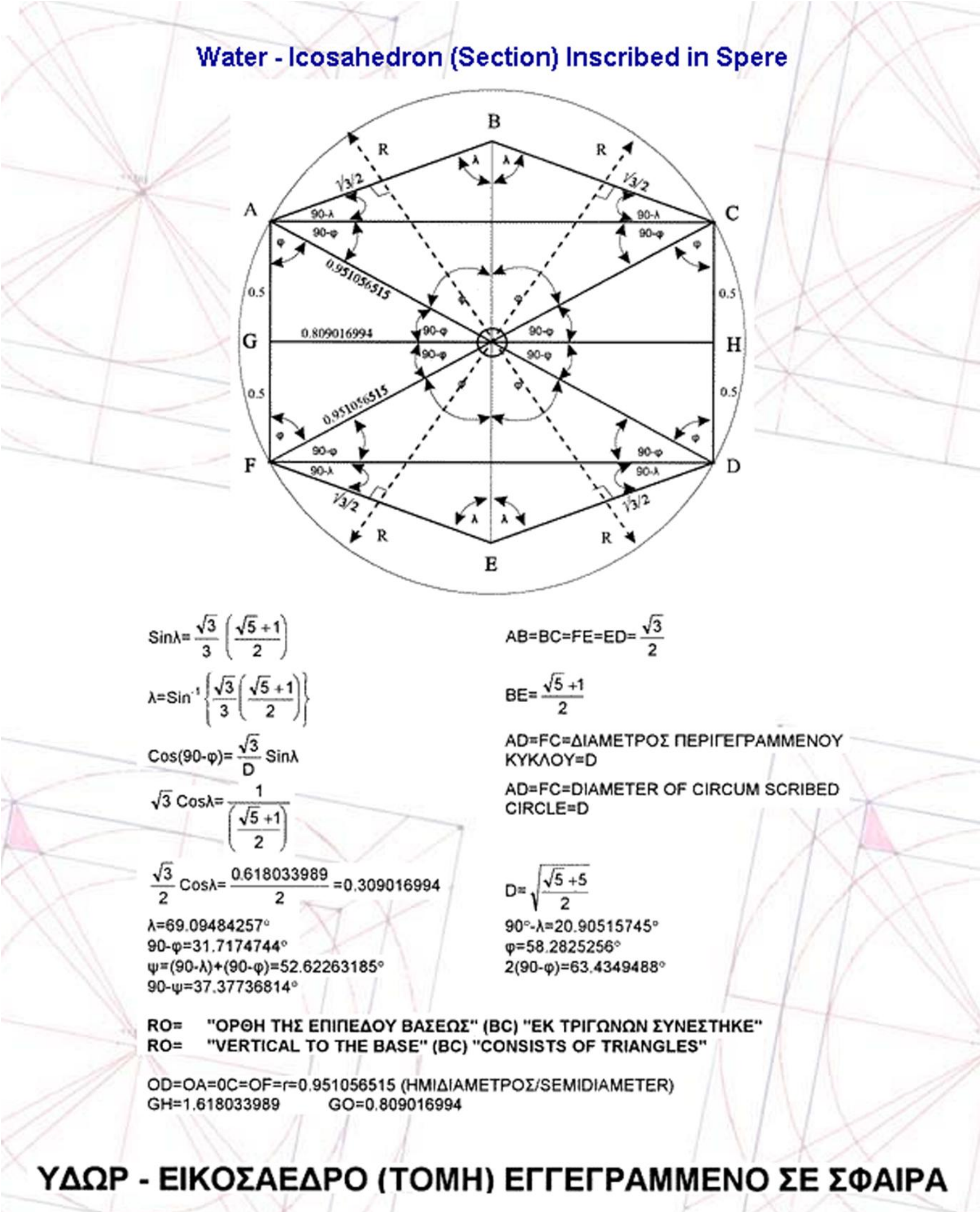

Water - Icosahedron (Section) Inscribed in Spere
B
A
C
G
H
F
D
E
R
$\sqrt{3}/2$
90-λ
90-φ
φ
λ
0.5
0.809016994
0.951056515
$\text{Sin}\lambda = \frac{\sqrt{3}}{3}\left(\frac{\sqrt{5}+1}{2}\right)$
$\lambda = \text{Sin}^{-1}\left\{\frac{\sqrt{3}}{3}\left(\frac{\sqrt{5}+1}{2}\right)\right\}$
$\text{Cos}(90\text{-}\varphi) = \frac{\sqrt{3}}{D}\text{Sin}\lambda$
$\sqrt{3}\,\text{Cos}\lambda = \frac{1}{\left(\frac{\sqrt{5}+1}{2}\right)}$
$\frac{\sqrt{3}}{2}\text{Cos}\lambda = \frac{0.618033989}{2} = 0.309016994$
λ=69.09484257°
90-φ=31.7174744°
ψ=(90-λ)+(90-φ)=52.62263185°
90-ψ=37.37736814°
$AB=BC=FE=ED=\frac{\sqrt{3}}{2}$
$BE=\frac{\sqrt{5}+1}{2}$
AD=FC=ΔΙΑΜΕΤΡΟΣ ΠΕΡΙΓΕΓΡΑΜΜΕΝΟΥ ΚΥΚΛΟΥ=D
AD=FC=DIAMETER OF CIRCUM SCRIBED CIRCLE=D
$D=\sqrt{\frac{\sqrt{5}+5}{2}}$
90°-λ=20.90515745°
φ=58.2825256°
2(90-φ)=63.4349488°
RO= "ΟΡΘΗ ΤΗΣ ΕΠΙΠΕΔΟΥ ΒΑΣΕΩΣ" (BC) "ΕΚ ΤΡΙΓΩΝΩΝ ΣΥΝΕΣΤΗΚΕ"
RO= "VERTICAL TO THE BASE" (BC) "CONSISTS OF TRIANGLES"
OD=OA=0C=OF=r=0.951056515 (ΗΜΙΔΙΑΜΕΤΡΟΣ/SEMIDIAMETER)
GH=1.618033989 GO=0.809016994
ΥΔΩΡ - ΕΙΚΟΣΑΕΔΡΟ (ΤΟΜΗ) ΕΓΓΕΓΡΑΜΜΕΝΟ ΣΕ ΣΦΑΙΡΑ

Figure 15

and Figure 16 Decorated Platonic Solids

http://www.stefanides.gr/dec_plastic.htm

Figure 17 and Figure 18 Quadrature Presuppositions

http://www.stefanides.gr/theo_circle.htm ,

http://www.stefanides.gr/quad.htm

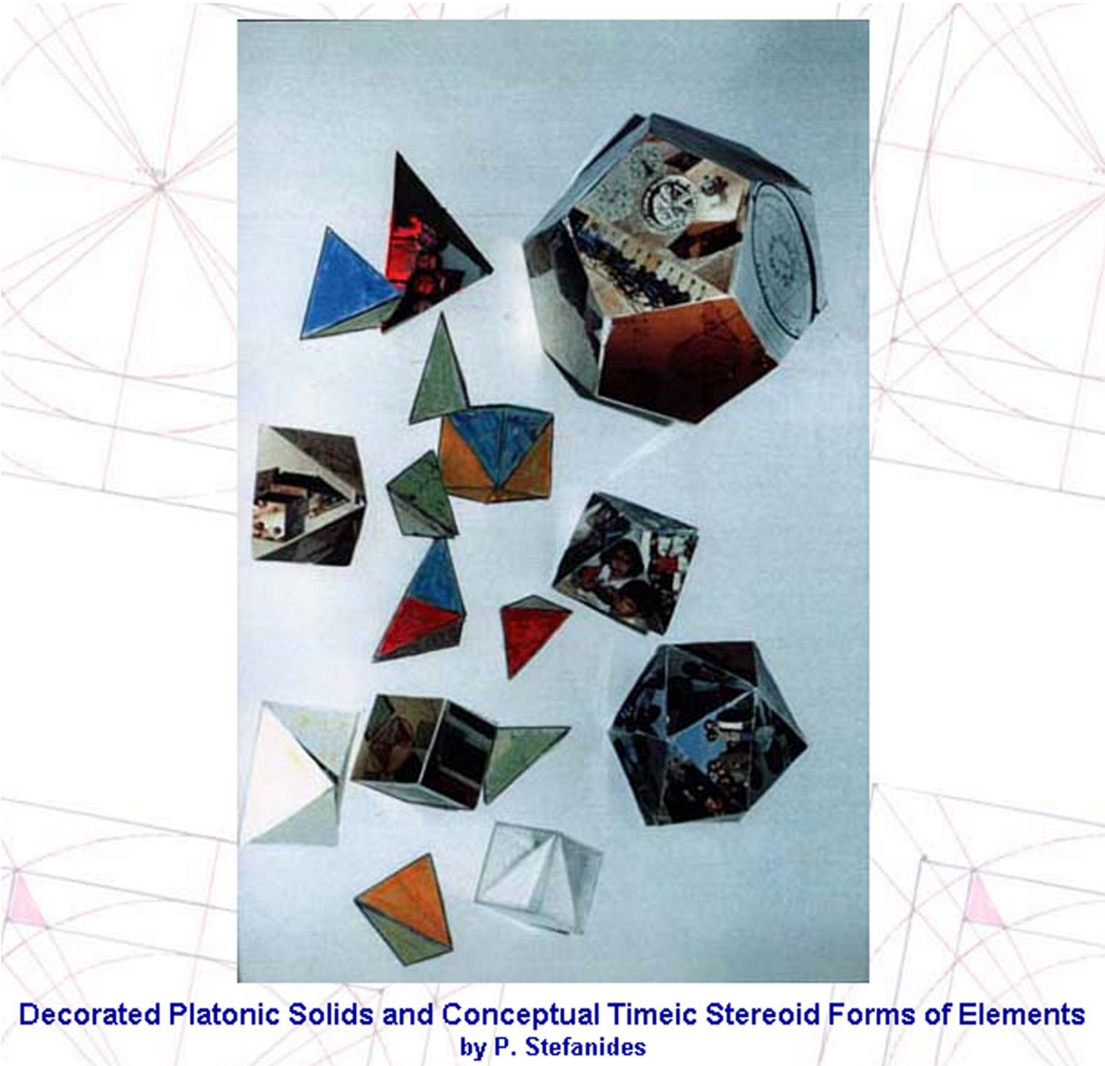
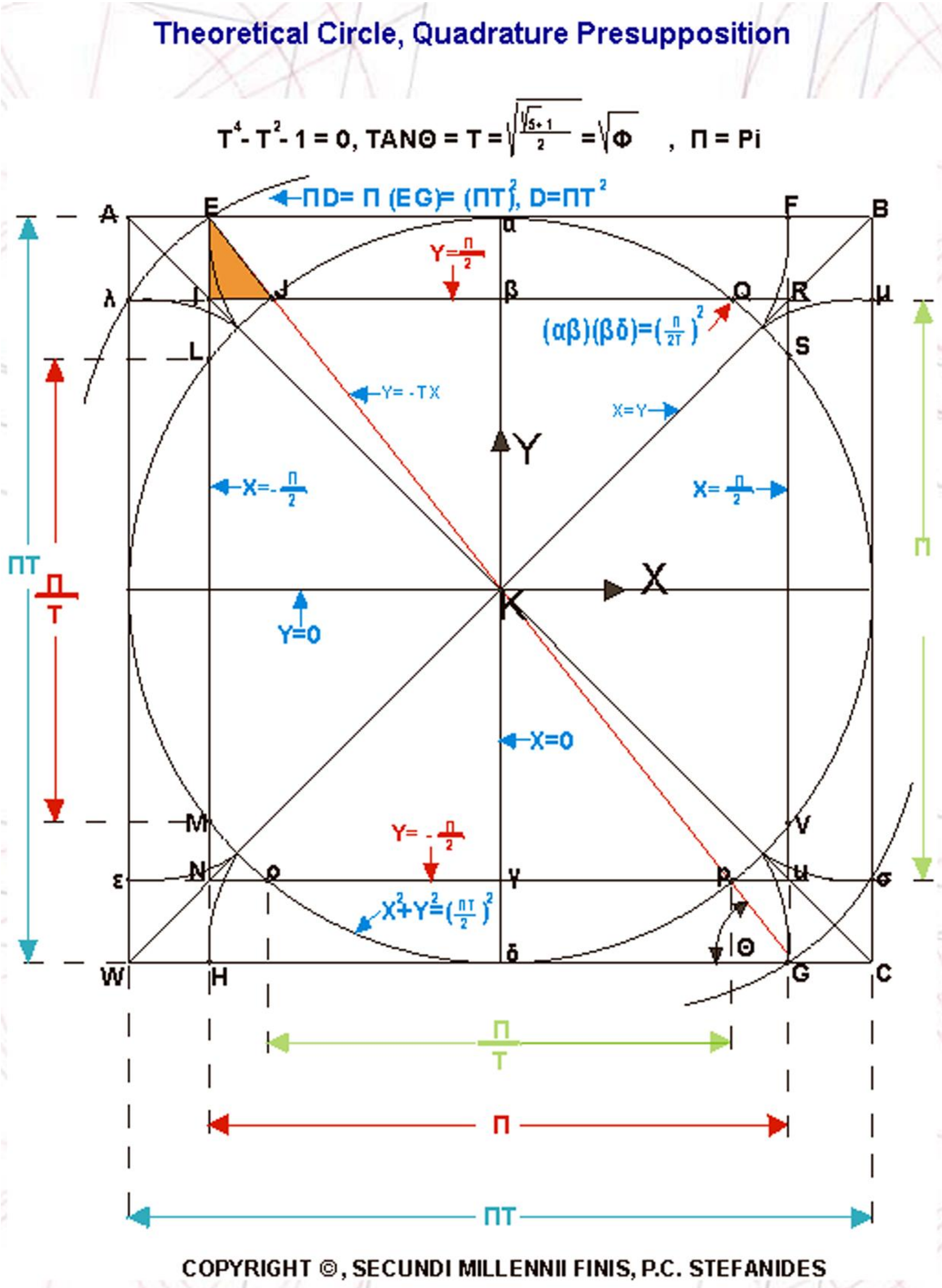

Decorated Platonic Solids and Conceptual Timeic Stereoid Forms of Elements
by P. Stefanides

Figure 16



Theoretical Circle, Quadrature Presupposition
T⁴- T²- 1 = 0, TANΘ = T = √(√5+1)/2 = √Φ , Π = Pi
ΠD= Π (EG)= (ΠT)², D=ΠT²
Y= Π/2
(αβ)(βδ)=(Π/2T)²
Y= -TX
X=Y
X=-Π/2
X= Π/2
Y
X
K
ΠT
Π/T
Y=0
X=0
Y= -Π/2
X²+Y²=(ΠT/2)²
Θ
Π
Π/T
Π
ΠT
A E F B
λ J Q R μ
L S
M V
ε N ρ γ P U σ
W H δ G C
α β
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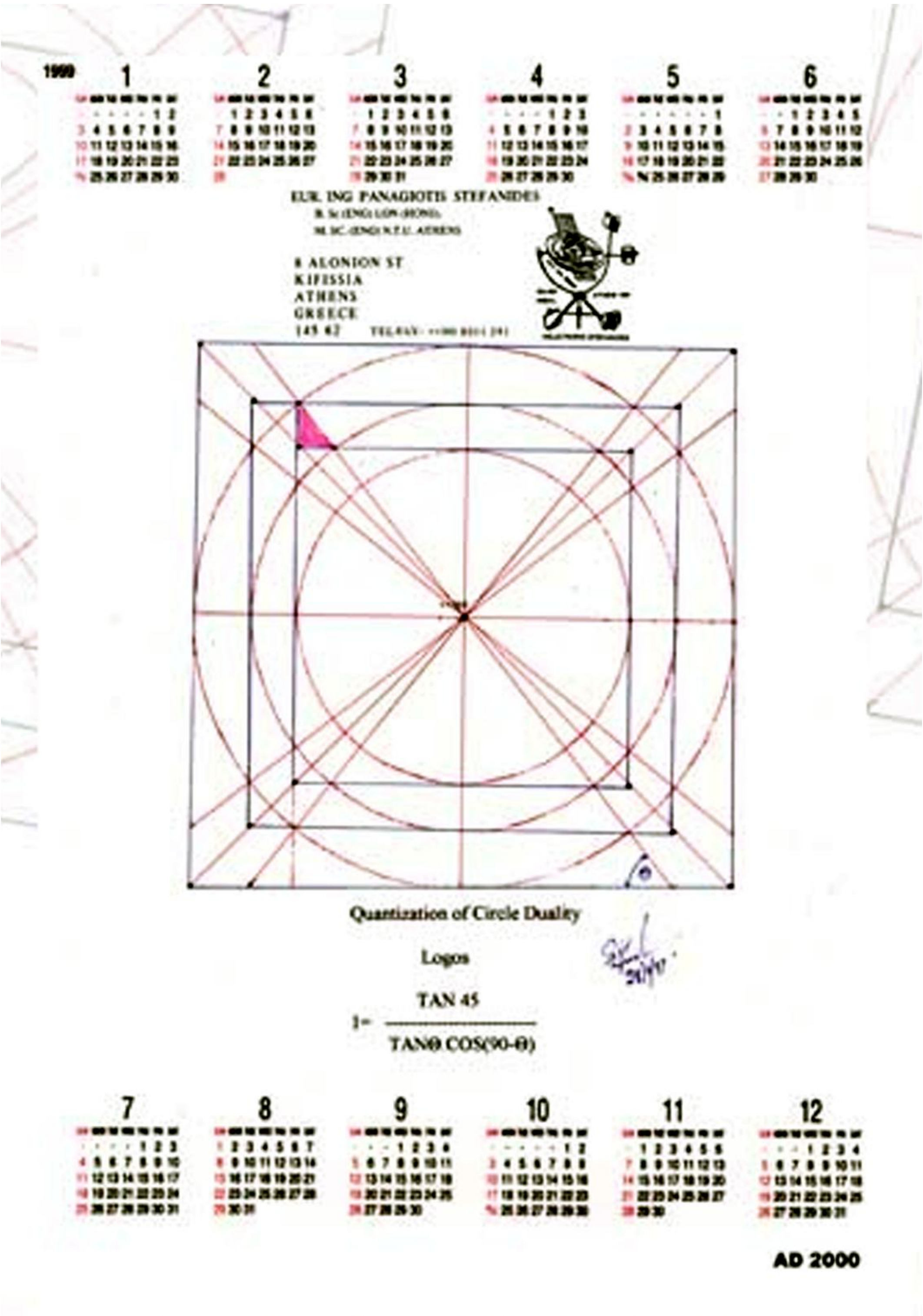
Figure 17



Quantization of Circle Duality

Figure 18

<u>CONCLUSIONS</u>
Via the Two ORTHOGONAL TRIANGLES
we get Symmetries and Relationships of Geometric Forms.
By interpeting, here, Plato's Philosophical concepts, that,
Fire/Air is equal to Air/Water is equal to Water/Earth,
we perceive that he correlates, as his Unified Theory, the structures of the
Five SOLID ELEMENTS
Fire, Air, Earth, Water and Aether,
through Ratios of the "ELEMENTAL SIDES" of ORTHOGONAL TRIANGLES, involving the
Four ELEMENTS Fire, Air, Earth, and Water, as Ratios, and by so,
we realize his statement that all triangles, Structuring the BODIES of the ELEMENTS , derive from two ORTHOGONAL TRIANGLES
the ISOSCELES and the SCALENE.

REFERENCES

1. THE GEOMETRY OF ART AND LIFE MATILA GHYKA DOVER PUBLICATION, INC. NEW YORK 1977.
2. LE NOMBRE D' OR MATILA C. GHYKA GALLIMARD 1959.
3. PARTHENON THEOPHANIS MANIA, PYRINOS COSMOS 1987.
4. TA AGNOSTA MEGALOURGIMATA TON ARCHAEON ELLINON THEOPHANIS MANIAS PYRINOS COSMOS 1981.
5. SACRED GEOMETRY ROBERT LAWLOR THAMES AND HUDSON 1982.
6. THE MOST BEAUTIFUL TRIANGLE - PLATO'S TIMAEUS P.C.STEFANIDES, FIRST CONFERENCE OF HISTROY AND PHILOSOPHY OF ANCIENT GREEK MATHEMATICS MATHEMATICAL SOCIETY RESEARCH INSTITUTE 2, 3 AND 4 MARCH 1989.
7. GEOMETRIC CONCEPTS IN PLATO–RELATED TO ART P.C. STEFANIDES, DEMOKRITEIO UNIVERSITY, 22-23 AND 24 NOV. 1991 CONFERENCE OF THE CHAMBER OF ECASTIC ARTS OF GREECE- XANTHE.
8. DIVISION IN EXTREME AND MEAN RATIO, ROGER HERZ-FISCHLER.
9. GOLDEN ROOT SYMMETRIES OF GEOMETRIC FORMS P.STEFANIDES, SYMMETRY FESTIVAL 2006, BUDAPEST. SYMMETRY: Culture and Science ISSN 0865-4824
10. GOLDEN ROOT SYMMETRIES OF GEOMETRIC FORMS P.STEFANIDES –SCIENCE AND ART CONFERENCE OF THE GREEK PHYSICIST'S ASSOCIATION AND OF THE ATHENS KAPODISTRIAN UNIVERSITY, PHYSICS SECTION, ATHENS- GAZI, 16 JAN. 2008.

LINKS:

http://www.stefanides.gr
http://www.stefanides.gr/Html/GOLDEN_ROOT_SYMMETRIES.htm
http://symmetry.hu/festival2006.html
http://www.direito.up.pt/IJI/node/62
http://curvebank.calstatela.edu/log/log.htm

ABSTRACT

The theory behind this work is based on my, interpretation of Plato's Timaeus 'ORTHOGONAL TRIANGLES" Structuring the Elemental Bodies, the "MOST BEAUTIFUL" and the " ISOSCELES" [Pl. Ti 54 B] and also of similar interpretation of the"SOMATOIDES" and the" STEREOID-MOST BEAUTIFUL BOND" [Pl.Ti.31B-32 B] Related, also, to this work, are Spirals and Logarithms. Of particular interest, to me, is a Form of the mollusk Nautilus, whose Shell Geometry, after measurements of a sample, found to be logarithmic, having as base that of the the SQUARE ROOT OF THE GOLDEN RATIO.

The Classical Greek word for SYMMETRY, "SYMMETRIA", means "WITH MEASURE", "IN MEASURE WITH," "DUE PROPORTION", "COMMON MEASURE", "HARMONY".

The existence of"SYMMETRY" CONTRASTS the CONDITIONS prevailed BEFORE the WORLD was CREATED, while all elements [FIRE, AIR, EARTH and WATER] were "WITHOUT PROPORTION"[Αλόγως] and "WITHOUT MEASURE"[Αμέτρως], and only "TRACES"[Iχνη] of them existed, as all things, naturally exist in GOD'S ABSENCE.

God, under these conditions, transformed them via "IDEAS" and "NUMBERS", for them to become "MOST BEAUTIFUL" and "BEST",as possible contrary to their previous state [Pl.Ti.53B].

BIOGRAPHY

Eur Ing Panagiotis Chr. Stefanides
BSc(Eng) Lon(Hons) MSc(Eng)NTUA TEE CEng MIET,
Head of Standards and Certification EMC Hellas SA,
Affiliate of HAI.

Born: 05.01.1945, Aegaleo, Athens.

Professional and Academic Qualifications:

2002	Chartered Engineer of the Engineering Council (UK),
2002	Member of the IEE [IET] ,
1997	Certified Lead Auditor [Cranfield University],
1977	Member of the Technical Chamber of Greece TEE,
1975	Electrical and Mechanical Engineer of the Technical University of Athens,
1974	Electrical Engineer of the University of London .

Professional Experience:

2008-1978	[HAI] Electromagnetic Compatibility , EMC Hellas SA, Affiliate of HAI, Research and Development Engineer, of the Electronic Systems Tests and Certification, Engineering Quality and Reliability Section Engineer, and HAI's Quality System Lead Auditor, Engines' Directorate Superintendent, Managed the Engineering Methods Division of the M53P2 Engine Nozzle Manufacturing, of the SNECMA- HAI Co-production Programme, Engines' Tests and Accessories Superintendent, Engines' Electrical Accessories Supervisor.
1978-1974	G.E., Athens Representatives, Sales Engineer / Assistant Manager, Continental Electronics Dallas Texas, and EDOK-ETER Consortium Engineer, of a 2MW Superpower Transmitters' installation Programme, in Saudi Arabia, Chandris Shipyards Engineer and Vessel repairs Superintendent, Salamis Island.

Training:

Public Power Corporation [GR], Sizewell Nuclear Power Station [UK], Oceangoing Steamship [S/S Chelatros] and Motor Vessels' Navigation [Celestial, Radio, Coastal] and Engines', of "Kassos" Shipping Co. Ltd. [R&K London].Presentations, Publications, Conferences, Awards :

http://www.stefanides.gr/Pdf/CV_STEFANIDES.pdf .