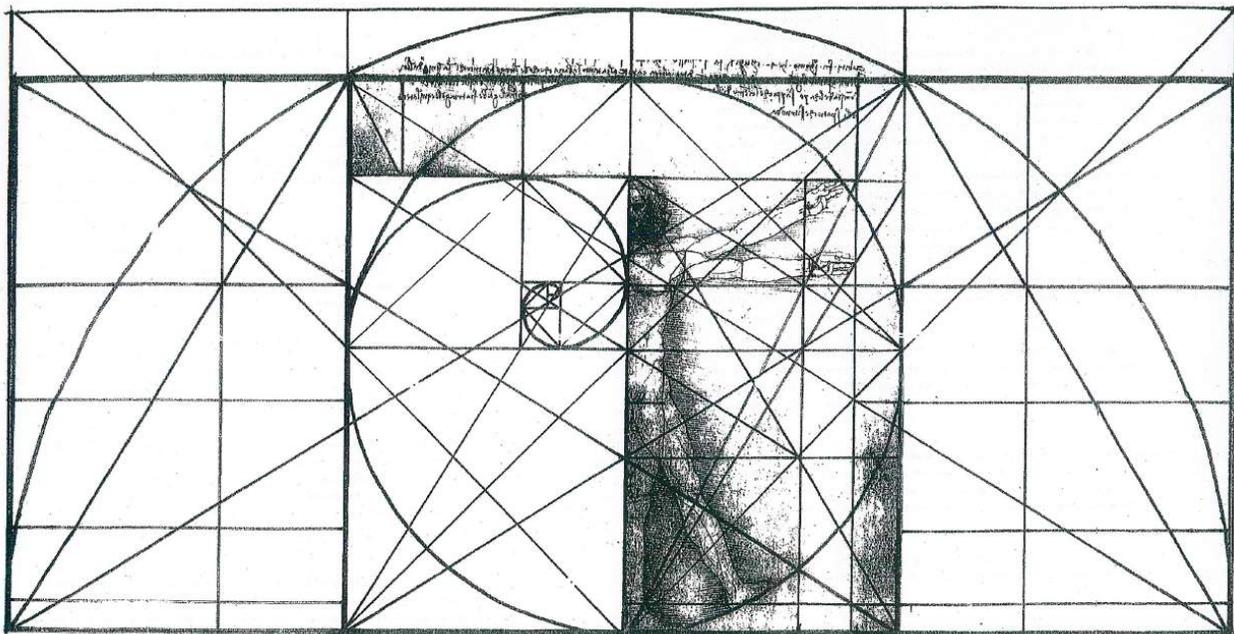


REDISCOVERING THE PARTHENON

How Its Architects and Sculptors Used the Golden Rectangle, the Root Five Rectangle and Dynamic Symmetry Geometry

Kenneth Hewes Barricklo, Architect

The underlying design principle of the Parthenon, 447 BCE, has been an enigma that many have sought to comprehend. My fifty years of practice and experience as an architect and as an independent scholar of Sacred Geometry have brought me to a proof of the use of Dynamic Symmetry (1) in the design of the Parthenon. This Fractal Geometry manifests a unified system that follows Vitruvius' principles and can be used to describe all aspects of the Parthenon's design thus revealing the Greeks' belief that Nature, The Human, and the Cosmos all exist in Unity.



(1)*

Sacred Nature and Sacred Geometry

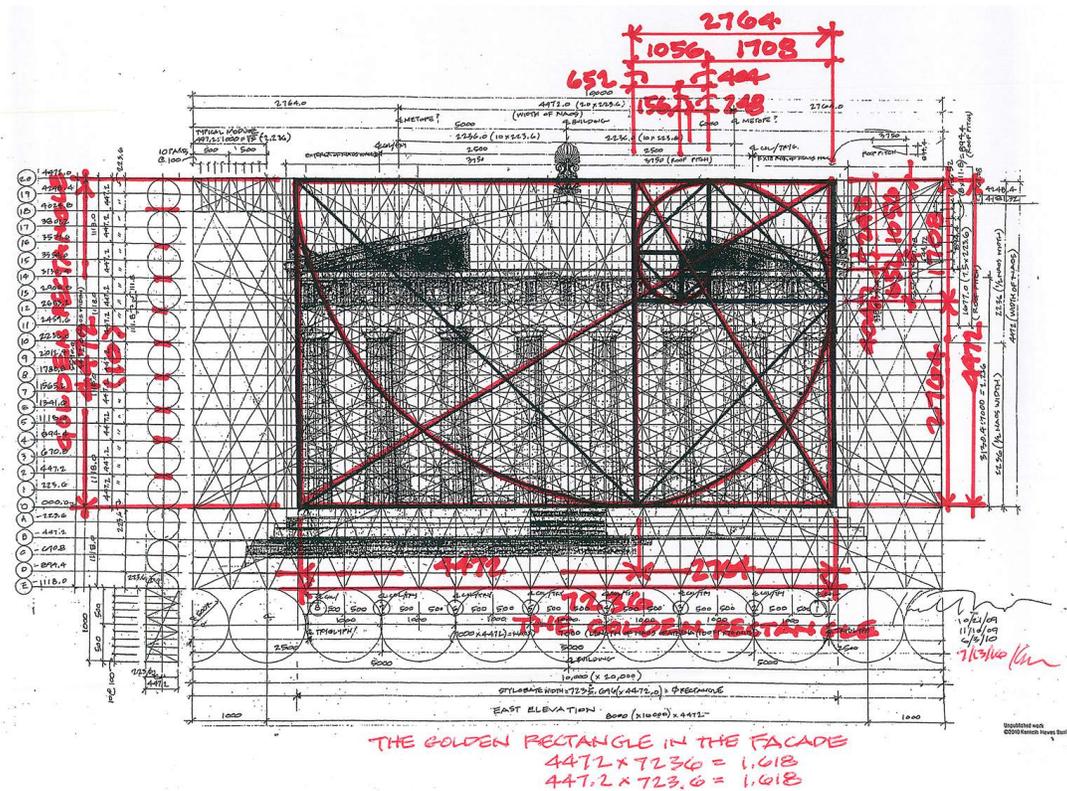
The Greeks believed that from the study of Nature comes an understanding of all things, as well as a knowledge of one's self. All things begin and end with Nature. Without an understanding of Nature, there can be no real meaning given to the human world in which we live. The beauty that we create in our life

* Please see pages 11-30 for the larger images

and art must always correlate with the Beauty of Nature, expressing something of the nature of the Human Being and the nature of Nature.

Sacred Geometry is the symbolic representation of Creation expressed through the use of the beautiful language of geometry with sacred numbers, shapes, forms, and spaces, symbolizing ancient humans' beliefs of esoteric and mystical meanings in their Life. The original Creation can be represented as a very simple symbol, a dot, which then geometrically flowers and transforms into myriads of interrelated, symbolic diagrams and exquisite patterns. Growth and Transformation signify the forever changing principles in Nature. Human beings have used multiple patterns and aspects of Sacred Geometry in their designs of architecture and art to give shape and form to their beliefs, creation myths, and understanding of Nature, The Human, and the Universe.

All things of Nature can be understood as a microcosm of a macrocosm and that same macrocosm as a microcosm of another larger Macrocosm. (18) This paradox can be manifested as a vibration, oscillation, wave, current, serpentine or spiral with its reversing spiral, and it was known by the ancients as existing in Nature as a reality. Thus, the Golden Rectangle and its Golden Mean Proportional Spiral can be seen as symbolizing the Diversity within Unity, the Fractal nature of Nature, the nature of Humans, and the nature of the Cosmos.



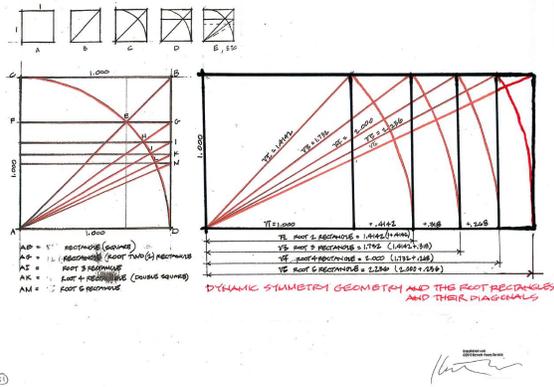
(18)

What I have Done

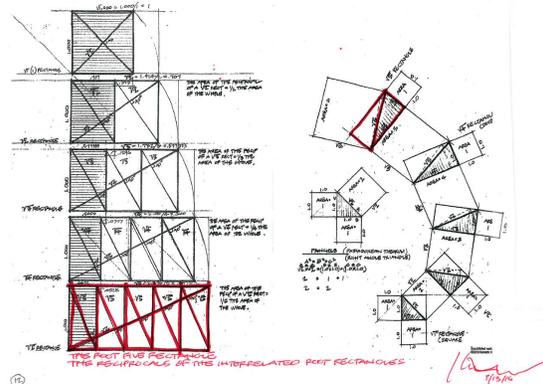
Jay Hambidge in *The Elements of Dynamic Symmetry* (1919 CE) described a lost geometry he believed was used to design the shapes of Greek vases and possibly sacred temples, including the Parthenon.

(11,12) After studying Hambidge's work, I came to realize that Dynamic Symmetry is a "fractal" system of interrelated Square Root Rectangles. Each Square Root Rectangle can be subdivided to produce

reciprocals of smaller, similar rectangles, and those rectangles can be subdivided infinitely. ("Fractal Geometry" was coined by Benoit Mandelbrot in 1975 CE).

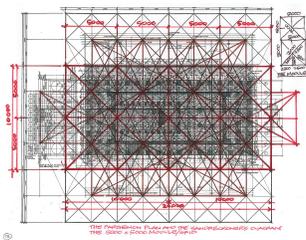


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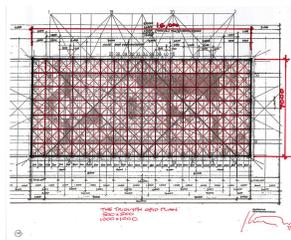


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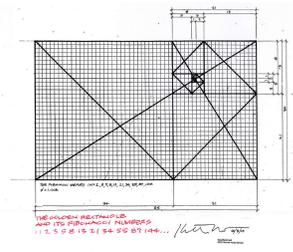
This led me to understand that there are four geometrical diagrams used in the design of the Parthenon: the Square and its grid lines (13,14), the Golden Rectangle and its Fibonacci Series of numbers (10,18), the Root Five Rectangle and its relationship to the Golden Rectangle (16,17), and the Root Five Rectangle and its reciprocal subdivisions (19,20). When these diagrams are used in the "ground plan, elevation, and perspective" (Vitruvius 30 BCE), they create the three dimensional form of the Temple. (21) In addition, smaller fractal Squares, Golden Rectangles, and Root Five Rectangles serve as "modules" that establish the proportional grid line relationships for positioning all of the other architectural elements.



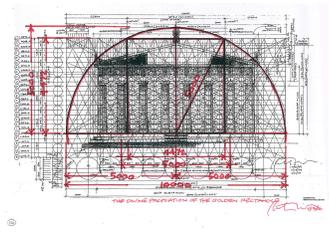
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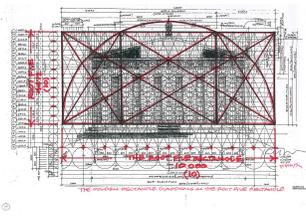
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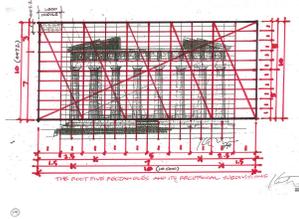
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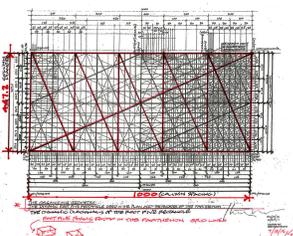
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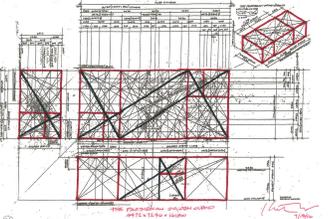
(17)



(19)



(20)



(21)

How I Worked on my Study

I have put myself in the place of a Greek architect of 500 BCE. Using only the tools that an architect of the time would have – a straightedge, triangles, and compass, I drafted all of my analysis drawings by hand. Neither he nor I had the advantages of computer technology or higher math. I used only a hand-held calculator to save the time of calculating or confirming varieties of proportions. By making all the drawings by hand, I had to take the time to draw, to meditate, and to fully experience the creation of the exquisite interrelated shapes and forms with their sacred proportions and meanings. Over the past seven years, I have made over 1000 drawings illustrating and interpreting this Sacred Geometry.

The Golden Section, the Golden Ratio, and The Golden Mean, were a mathematical and geometrical puzzle of interest to the ancients. Sacred Geometry, a language immersed in esoteric mysticism, was probably disclosed to very few masters, perhaps explaining why modern investigations are limited to the study of the remains of structures, and cannot be supplemented by treatises written at the time, now lost. Some believe that statements made by stone edifices are our only reliable guides for an inductive analysis of their actual designs. However, we do have many in-depth investigations and studies made by architects, scholars, and archeologists who have written about ancient architecture, geometry, art and their beauty. Among those referenced in my proof are the following: Jay Hambidge, 1915 CE; Vitruvius, 30 BCE; Leon Battista Alberti, ca. 1450 CE; Luca Pacioli, 1490 CE; Leonardo Da Vinci, 1490 CE; Protagoras, 447 BCE; Pythagoras, 500 BCE; Fibonacci, 1200 CE; Iktinos, Kallikrates, Pheidias, 447 BCE; Benoit Mandelbrot, 1975 CE.

Vitruvius, On the Art of Building

In 30 BCE, during the reign of Caesar Augustus, the Roman architect Marcus Vitruvius Pollio wrote *De Architectura, The Ten Books on Architecture*. This architectural treatise would be used by future Roman architects to design and construct temples and other buildings throughout their Empire. (2)

Vitruvius states in his treatise “*Architecture depends on Order, Arrangement, Eurythmy, Symmetry...*”

“Order gives due measure to the members of a work considered separately, and symmetrical agreement to the proportions as a whole...Arrangement includes the putting of things in their proper places and the elegance of effect which is due to adjustments appropriate to the character of the work. Its forms of expression are the ground plan, elevation, and perspective.”

“Eurythmy is beauty and fitness in the adjustments of the members. This is found when the members of a work are of a height suited to their breadth, of a breadth suited to their length, and in a word, when they all correspond symmetrically.” (Here he is speaking not only of two dimensional planes, but, three dimensional forms as well.)

“Symmetry is a proper agreement between the members of the work itself, and relation between the different parts, and the whole general scheme, in accordance with a certain part selected as standard (canon). Thus, in the human body there is a kind of symmetrical harmony between forearm, foot, palm, finger, and other small parts; and so it is with perfect buildings. In the case of temples, symmetry may be calculated from the thickness of a column, from a triglyph, or even from a module.”(2)

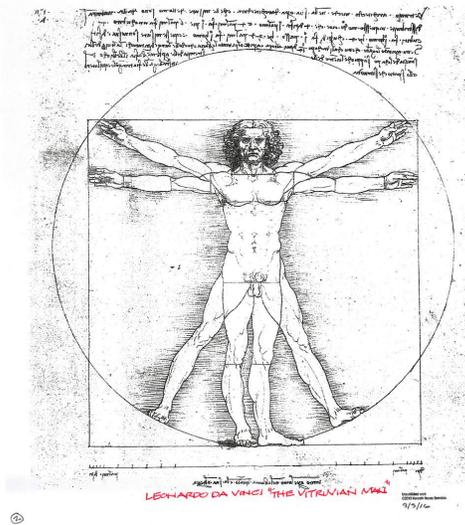
From, "On Symmetry: In Temples and in the Human Body", Vitruvius goes on to say, "in the members of a temple there ought to be the greatest harmony in the symmetrical relations of the different parts to the general magnitude of the whole."

Then again, "in the human body the central part is naturally the navel. For if a man be placed on his back, with his hands and feet extended, and a pair of compasses centered at his navel, the fingers and toes of his two hands and feet will touch the circumference of a circle described there from."⁽³⁾

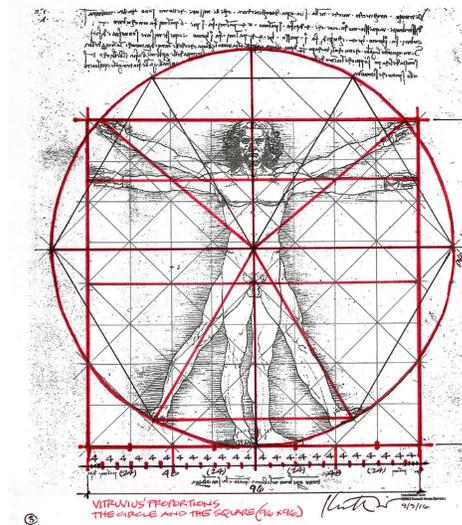
"And just as the human body yields a circular outline, so too, a square figure can be found from it. For if we measure the distance from the soles of the feet to the top of the head, and then apply that measure to the outstretched arms, the breadth will be found to be the same as the height, as in the case of plane surfaces which are perfectly square."⁽³⁾

"Therefore, since nature has designed the human body so that its members are duly proportioned to the frame as a whole, it appears that the ancients had good reason for their rule, that perfect buildings must be in exact symmetrical relations to the whole general scheme. Hence, while transmitting to us the proper arrangements for buildings of all kinds, they were particularly careful to do so in the case of temples of the gods, buildings in which merits and faults usually last forever."

"Further, it was from the members of the body that they derived the fundamental ideas of the measures which are obviously necessary in all works, as the finger, palm, foot and cubit. These they apportioned so as to form the perfect number, and as the perfect number the ancients fixed upon ten. For it is from the number of the fingers of the hand that the palm is found, and the foot from the palm. Again, while ten is naturally perfect, as being made up by the fingers of two palms, Plato also held that this number was perfect because ten is composed of the individual units."⁽³⁾



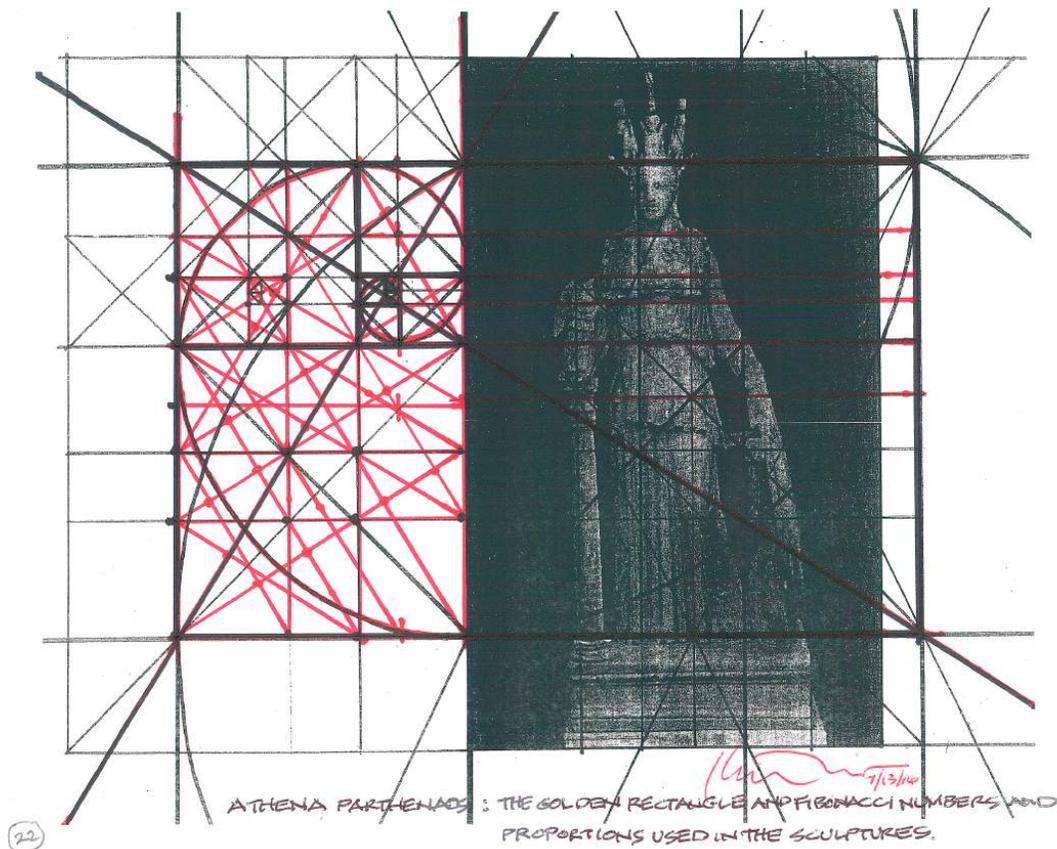
(2)



(3)

Leonardo Da Vinci (2,3)

At the beginning of the Renaissance with the rediscovery of *De Architectura*, Da Vinci drew *The Vitruvian Man*. His detailed drawing illustrated the proportions of the human body as described by Vitruvius in 30 BCE. In 1490 CE, after having studied the Golden Mean proportions with Luca Pacioli, who had written *Divina Proportione*, Da Vinci knew that the divisions and proportions as described by Vitruvius were not real proportions found in the human body or Nature. They were an *abstract idea*, creating an *idealized* proportion as a "standard". As an example, I have illustrated the Golden Mean proportions of the human body in relation to the sculpture of Athena Parthenaos representing its use in the sculptures of the Parthenon. (22)



(22)

I believe that Vitruvius' description of human proportions, as understood by the ancients, symbolizes man's oldest known and most profound understanding of the Human body and its golden mean proportional relationship to Nature and the Cosmos.

Although Vitruvius did not specifically mention the Parthenon in *De Architectura*, I applied all of his principles for designing sacred temples and have proven their use throughout the design of the Parthenon.

The Golden Age of Pericles, 5th Century BCE

The Human Hands are believed to be the origin for all Numbers and Counting Systems.

There are five (5) fingers on each hand and ten (10) fingers for both hands. Four (4) fingers make the Palm. (See Vitruvius and "The Vitruvian Man", above) (7)

Protagoras, a friend of Pericles, believed "Man is the Measure".

The proportional height of the idealized Human body was the canon of "measure and proportion" that was used in the design of the Parthenon.

Pythagoras and the Tetraktys: The Perfect Sacred Numbers Five, Seven, and Ten (8,9)

The Tetraktys is a triangle consisting of one (1) dot, over two (2) dots, over three (3) dots, over four (4) dots. Pythagoras believed it could be used to geometrically represent everything in Nature, The Human, and the Cosmos.

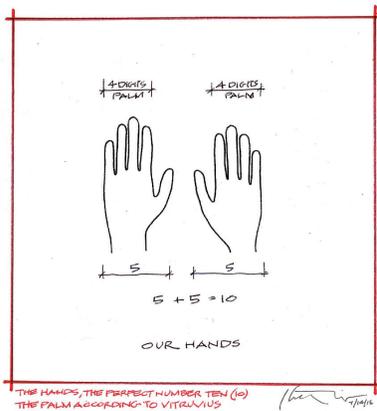
1, 2, 3, 4, 5, 6, 7, 8, 9, 10 = the Ten Individual Units

The numbers 1 and 2 to the Pythagoreans were not numbers.

2 + 3 = 5 (five), the numbers of fingers on one hand

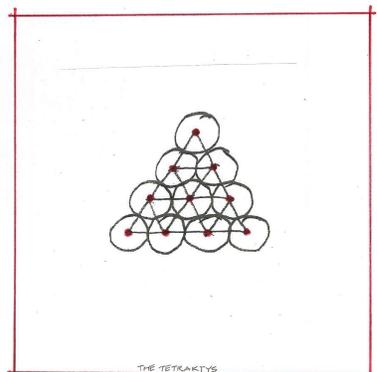
3 + 4 = 7 (seven), the Number of Wisdom: the first triangular number (3) plus the first square number (4).

1 + 2 + 3 + 4 = 10 (ten), the Perfect Number.



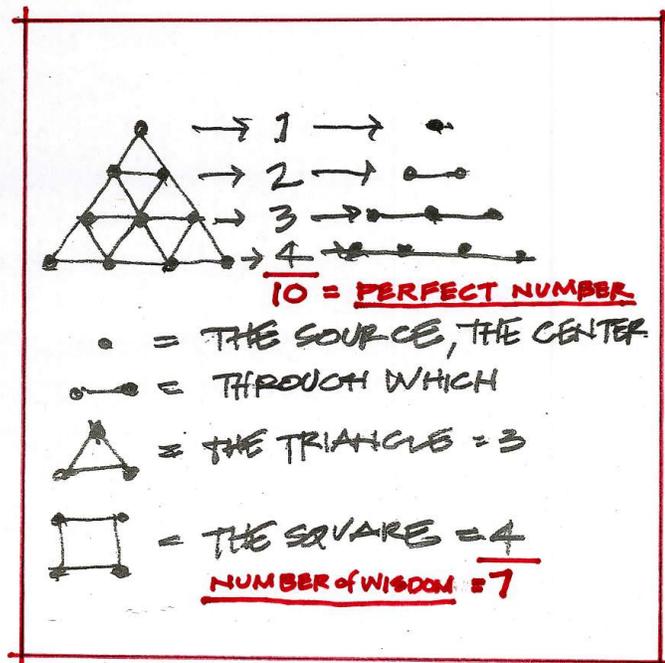
THE HANDS, THE PERFECT NUMBER TEN (10)
THE PALM ACCORDING TO VITRUVIUS

(7)



THE TETRAKTYS

(8)



THE TETRAKTYS, THE PERFECT NUMBER TEN (10)
THE NUMBER OF WISDOM SEVEN (7)
THE NUMBER FIVE (5)

(9)

The Tetraktys and the Golden Mean Series: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, ... (10, 18, 21)

The Golden Mean Series is believed to have been used by the Hindus, but it was only rediscovered in the 1200s CE in North Africa by Fibonacci.

$$1 + 2 + 3 + 4 + 5 + 6 = 21 \text{ a Fibonacci Number}$$

$$7 + 8 + 9 + 10 = 34 \text{ a Fibonacci Number}$$

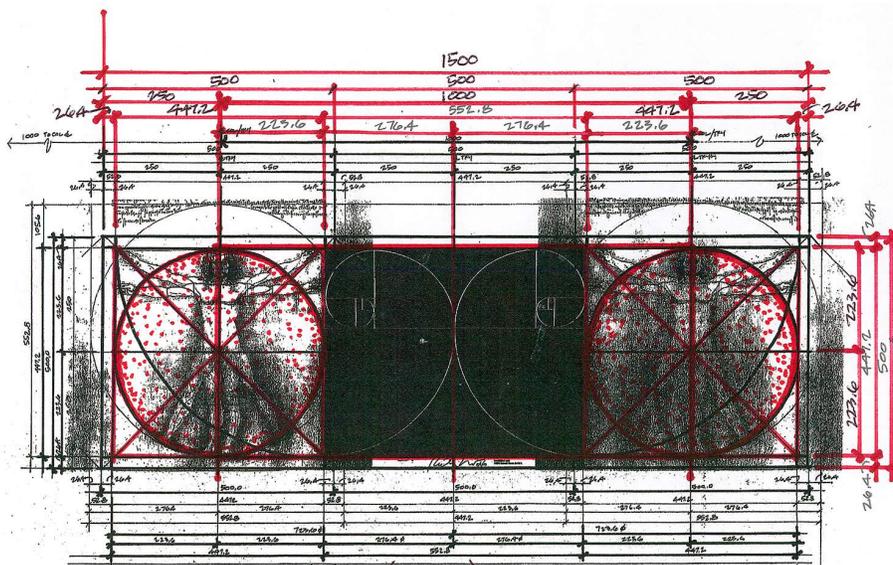
$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55 \text{ a Fibonacci Number}$$

Pythagoras understood that adding the Ten Individual Units of natural numbers to total 55 manifested a Golden Mean Series number. This fractal series is directly related to the Golden Rectangle and its inscribed Spiral. By dividing the smaller of two adjacent numbers into the larger, one approaches the idealized Golden Mean proportion of 1.618, e.g., $8/5 = 1.600$; $13/8 = 1.625$; $21/13 = 1.615\dots$; $89/55 = 1.618\ 18\ 18\dots$

Another Proportional Series (similar to Fibonacci numbers) is in decimal equivalents: $\dots .090, .146, .236, .382, .618, 1.000, 1.618, 2.618 \dots$ (irrational numbers rounded back to three decimal places). These, too, express the Golden Mean proportion by dividing the smaller of two adjacent numbers into the larger, e.g., $1.000/.618 = 1.618$. (6, 16, 17, 18, 22)

Pythagoras initially believed that only Natural numbers were numbers. Eventually though, Irrational numbers were accepted as being Real numbers by him before his death around 500 BCE.

The Greeks believed that everything in Nature, the Human, and the Cosmos (not just certain major numbers, proportions, measurements, rectangles, or selected elements) was in Unity.



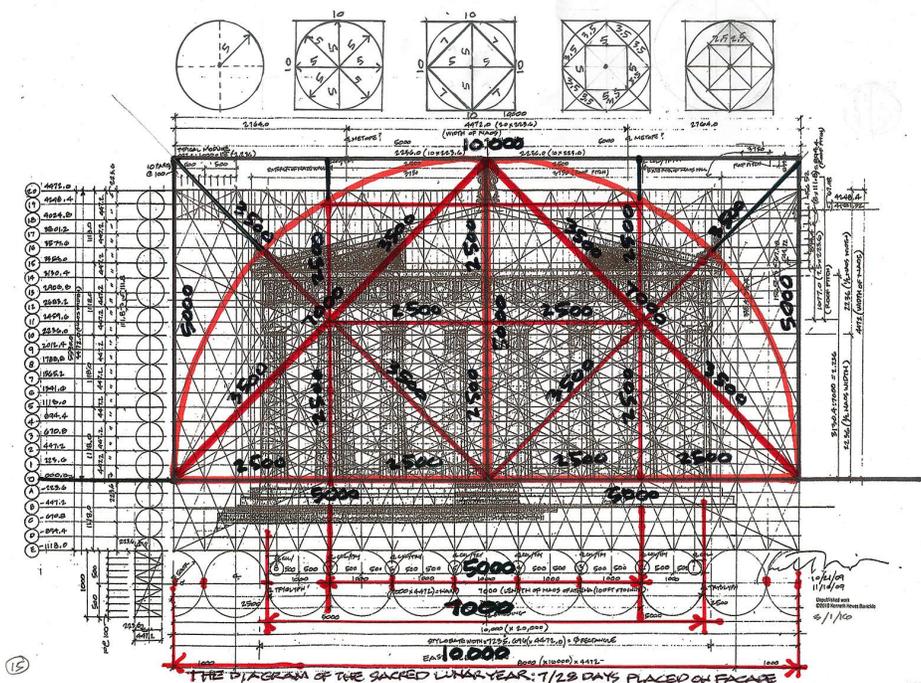
THE VITRUVIAN PROPORTION OF THE HUMAN (AS CANON) AND THE GOLDEN RECTANGLE MIRRORED

- THE 500 x 1500 GRID
- THE 441.2 x 1000 ROOT FIVE MODULE (1:2.236)
- THE 441.2 x 73.6 GOLDEN RECTANGLE
- THE 441.2 x 552.8 DOUBLE GOLDEN RECTANGLE
- THE 441.2 x 276.4 GOLDEN RECTANGLE
- THE 441.2 x 441.2 + 552.8 ROOT FIVE RECTANGLE
- THE 441.2 x 276.4 + 441.2 + 276.4 ROOT FIVE RECTANGLE
- 500/441.2 = 1.132 x 2 = 2.236 (THE SQUARE ROOT OF FIVE)

$\frac{1000}{441.2} = 2.268$
 $\frac{1000}{441.2} \times 2 = 4.536$
 $\frac{1118.0}{500} \times 2 = 2.236 = 500 \times 2.236 = 1118.0$
 $\frac{1118.0}{500} = 2.236$

A few of the most important numbers and proportions used to organize the architectural elements:

- The ground plan, elevation and form are related to the numbers 5, 7, and 10. The pre-Greeks could only calculate the diagonal of a 1x1 square to be 1.4. Hence, the diagonal of a 5x5 square was believed to be 7. (15)



(15)

The Triglyph Pattern of the frieze, the organizing pattern for the entire building, is a 1000 by 1000 grid, subdivided into a 500 by 500 grid. (14)

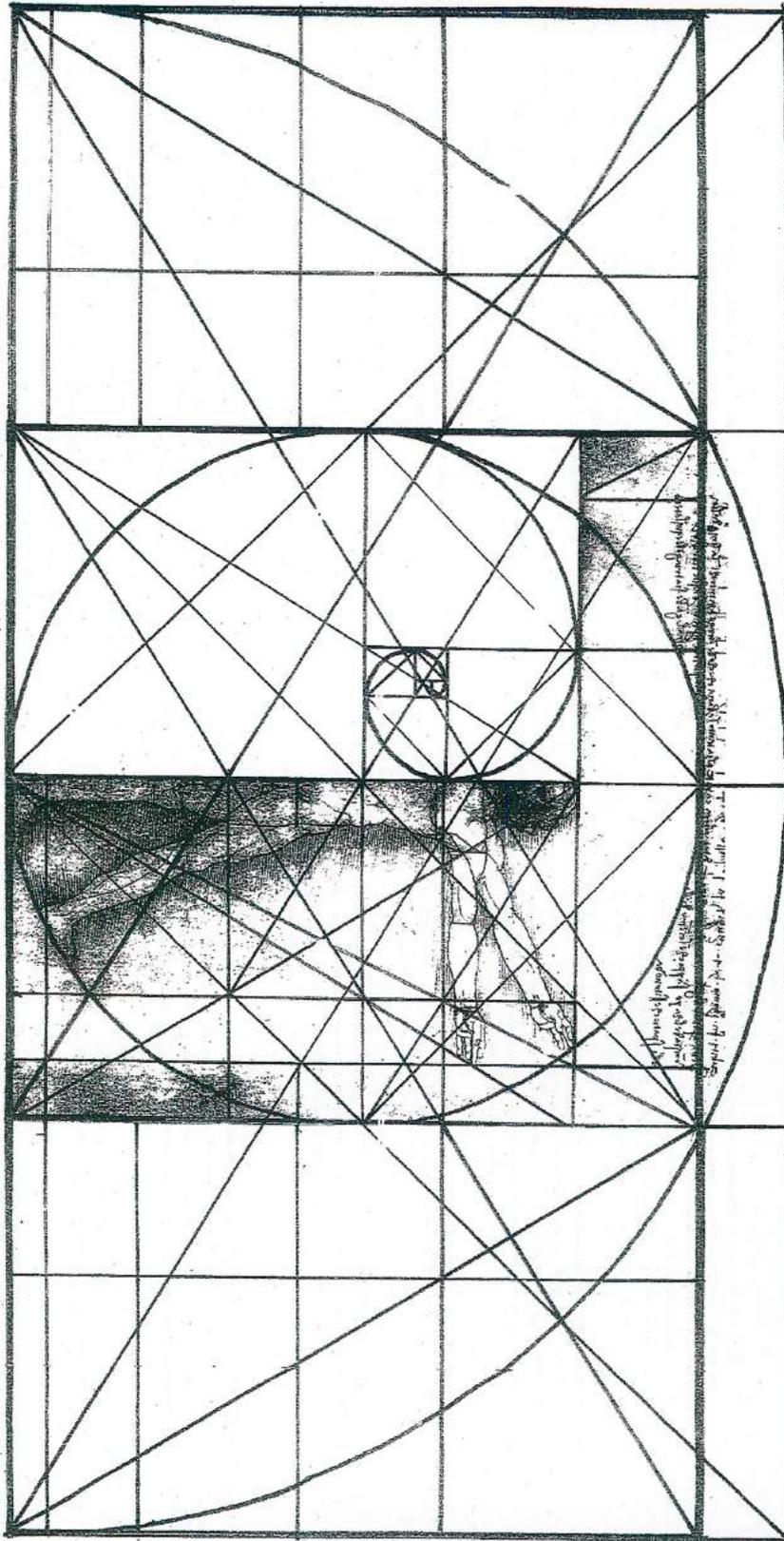
- Fractal modules of Root Five Rectangles and Golden Rectangles are used to organize the most significant architectural elements. (16,17,18,19,20)
- The primary rectangular proportion is the column diameter (human height) to the column spacing, 447.2 to 1000. Large to small reciprocal subdivisions of this module regulate all shapes and details. (6,20)
- Multiplying the Perfect Number 10 times Athena's Number of Wisdom 7 creates the proportional foot dimension, the Sacred Foot of 70 units.
- The most important proportional module and measurement used in the Temple is the *Hekatompedon*, the one hundred foot measure. As the Sacred Foot is 70 units long, the Hekatompedon can be expressed as having 7000 units ($100 \times 70 = 7000$). That 7000 unit measurement is revealed as the diagonal of a 5000 x 5000 square module. Smaller relationships of the measurement are revealed in the overall Triglyph Pattern (14) of the four exterior facades, the Inner Temple's plan and its exterior facade length (bottom step to bottom step), and the length of the floor plan of the Naos. (13,14,15,19)

My illustrations demonstrate how the architects Kallikrates and Iktinos and the sculptor Phidias designed their greatest work of art using a unifying geometry. The beautiful form and details of the Parthenon and its sculptures incorporate the proportions of this fractal Sacred Dynamic Symmetry in its architectural plan, elevations, and form, symbolizing the Human and Nature as microcosms of the Cosmos.

Conclusion

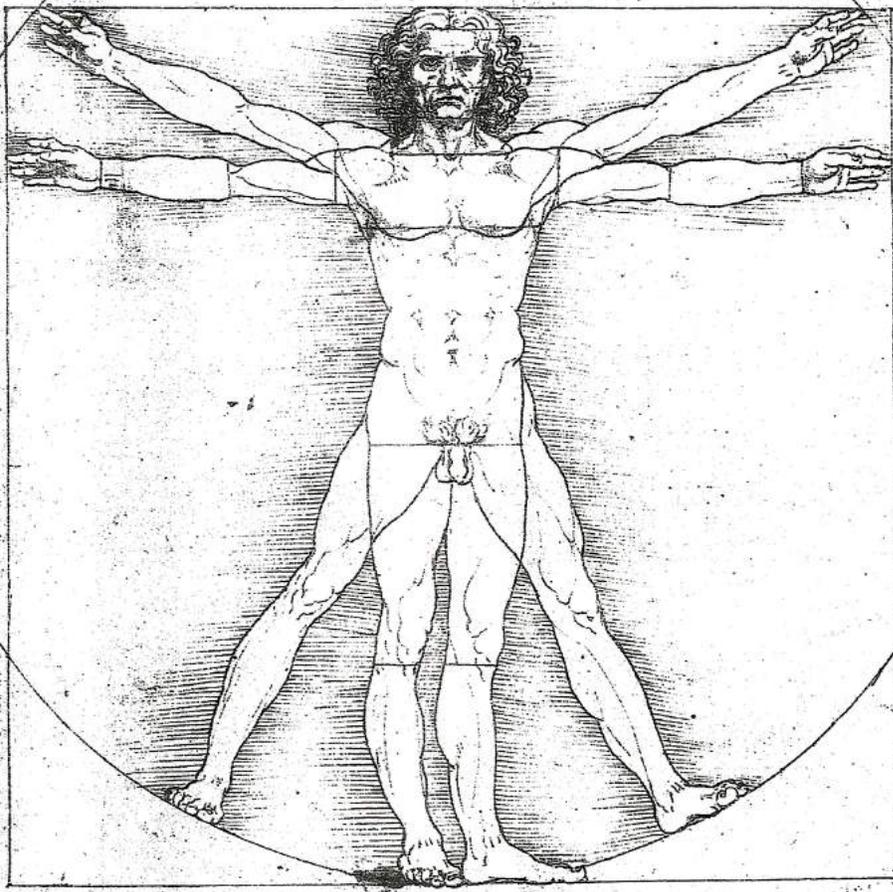
My body of work stands as a "Rosetta Stone" rediscovery of the long lost Canon of design and proportions used by the Greeks to design their architecture and art. This rediscovery may also be a key to an understanding of sacred architecture and art of other ancient cultures before, or contemporary with, the laying of the first stone of the Parthenon.

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Kenneth Hewes Barricklo



(1)

Handwritten text in a cursive script, likely a transcription of Vitruvius's text, located at the top of the page.



LEONARDO DA VINCI 'THE VITRUVIAN MAN'

Unpublished work
©2010 Kenneth Hayes Barnick
2/3/16

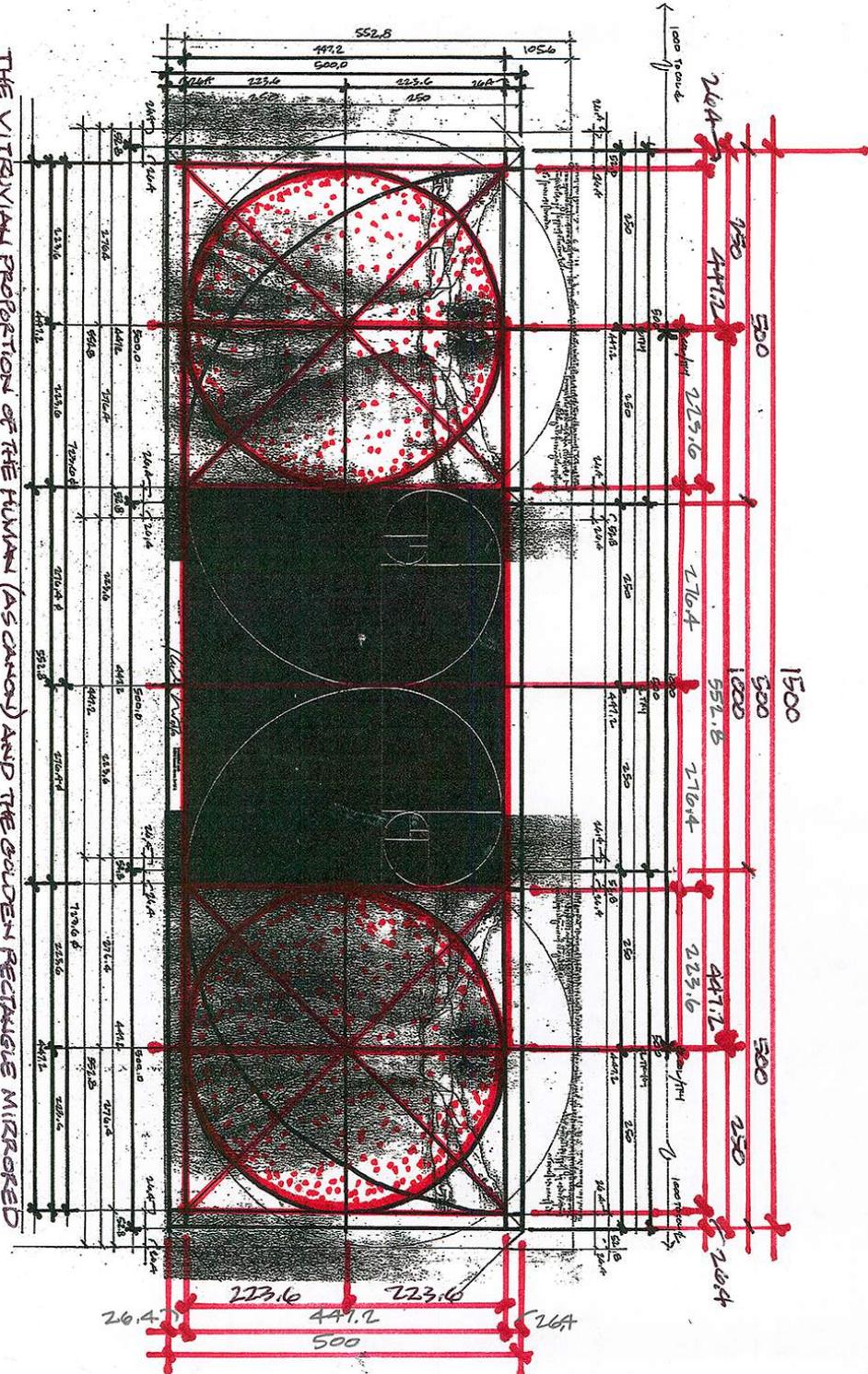
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6

THE VITRUVIAN PROPORTION OF THE HUMAN (AS CANON) AND THE GOLDEN RECTANGLE MIRRORED

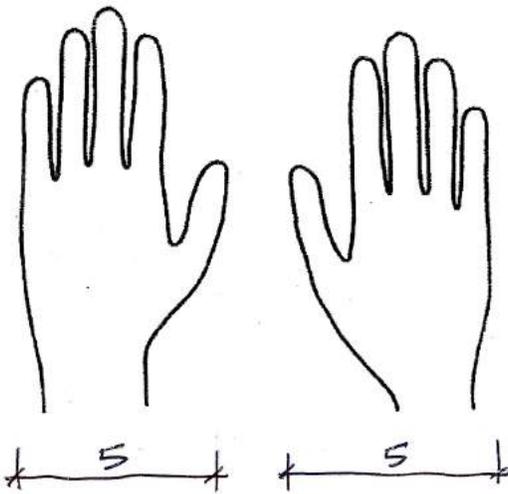
THE 500 x 1500 GRID
 THE 447.2 x 1000 ROOT FIVE MODULE (1:2.236)
 THE 447.2 x 723.6 GOLDEN RECTANGLE
 THE 447.2 x 552.8 DOUBLE GOLDEN RECTANGLE
 THE 447.2 x 276.4 GOLDEN RECTANGLE
 THE 447.2 x 447.2 + 552.8 ROOT FIVE RECTANGLE
 THE 447.2 x 276.4 + 447.2 + 276.4 ROOT FIVE RECTANGLE
 $500/447.2 = 1.118 \times 2 = 2.236$ (THE SQUARE ROOT OF FIVE)

THE DIAGONAL OF RECTANGLE 500 x 1000 = 1118.0 (1)
 THE DIAGONAL OF RECTANGLE 500 x 1500 = 1732.0 (2)
 $1118.0^2 = 1250000$
 $1732.0^2 = 3000000$
 $1250000 + 3000000 = 4250000$
 $\sqrt{4250000} = 2061.55$



| 4 DIGITS |
+-----+
PALM

| 4 DIGITS |
+-----+
PALM



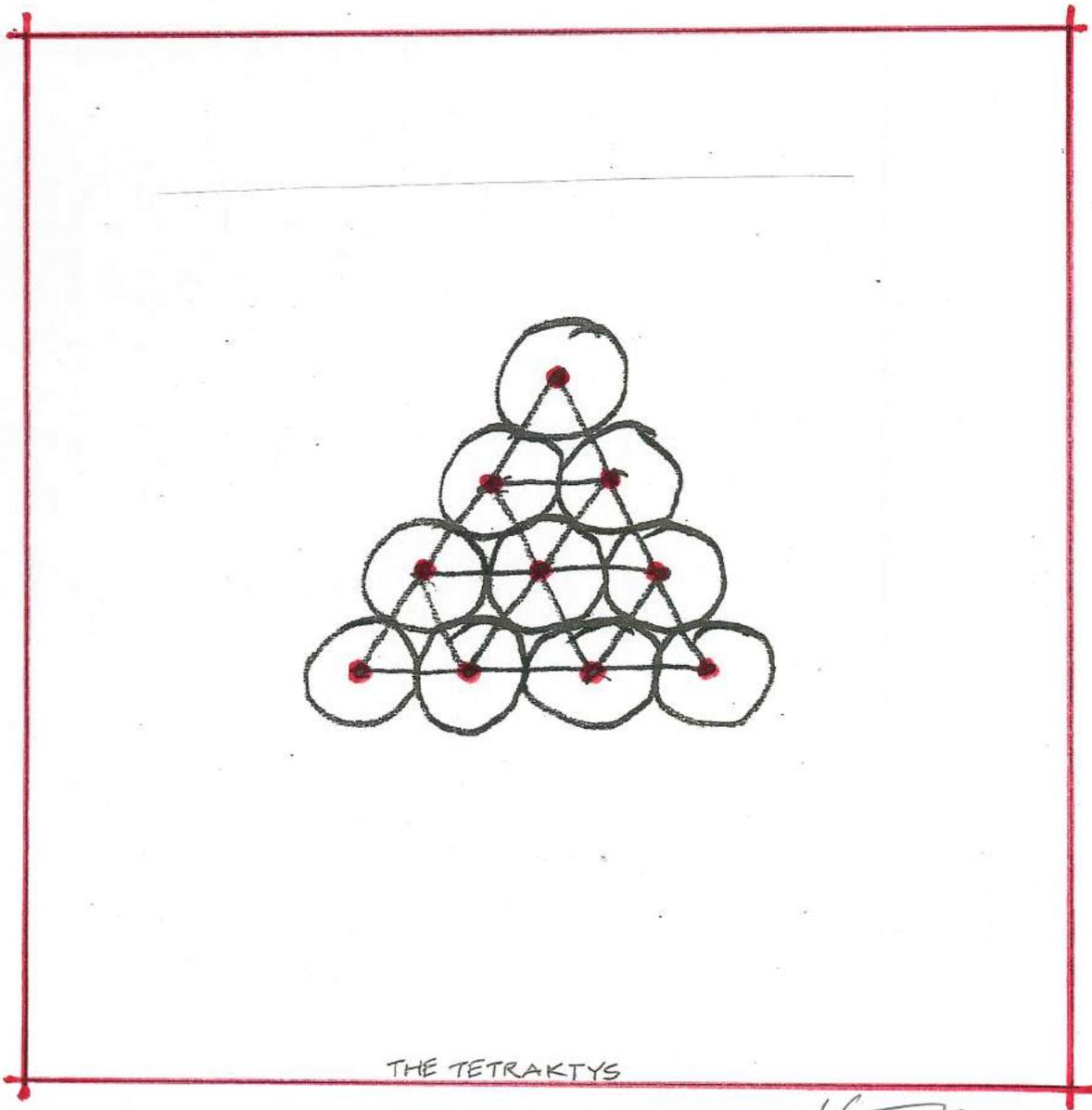
$$5 + 5 = 10$$

OUR HANDS

THE HANDS, THE PERFECT NUMBER TEN (10)
THE PALM ACCORDING TO VITRUVIUS

[Signature] 7/14/16

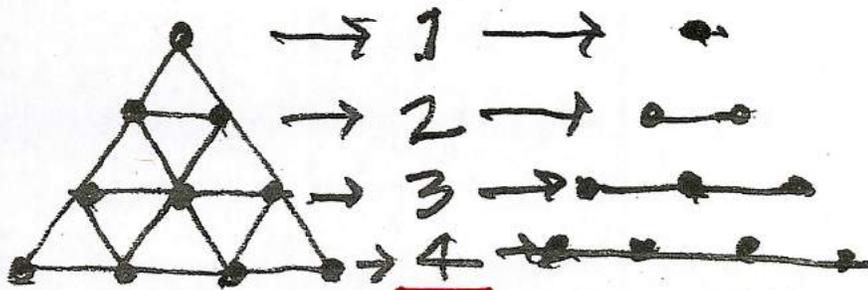
①



THE TETRAKTYS

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38



10 = PERFECT NUMBER

• = THE SOURCE, THE CENTER

—•— = THROUGH WHICH

△ = THE TRIANGLE = 3

□ = THE SQUARE = 4

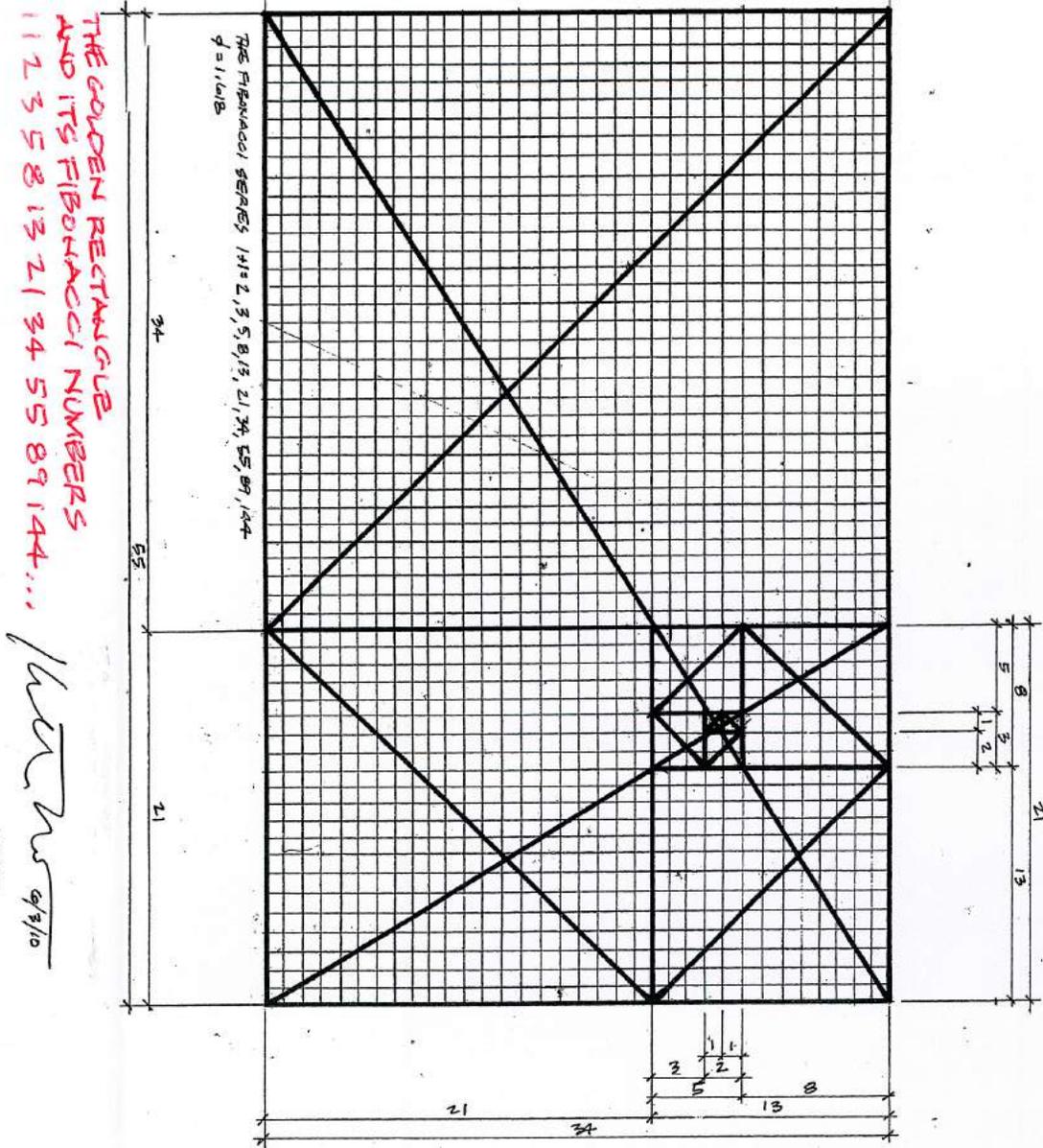
NUMBER OF WISDOM = 7

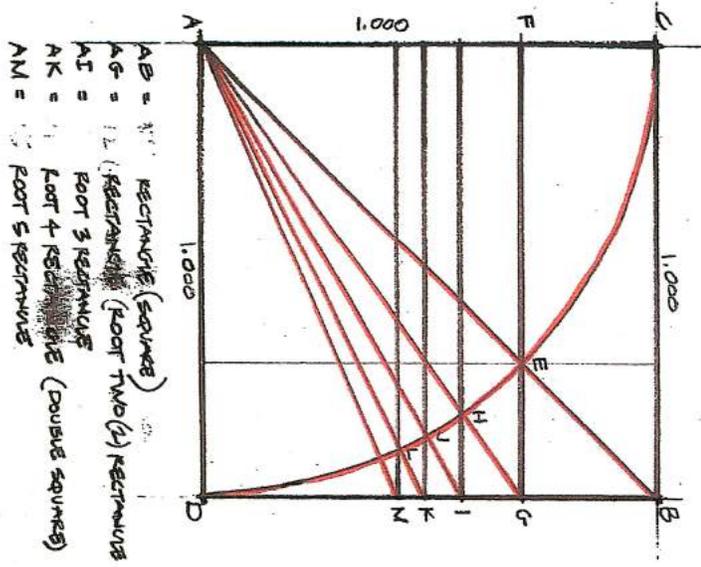
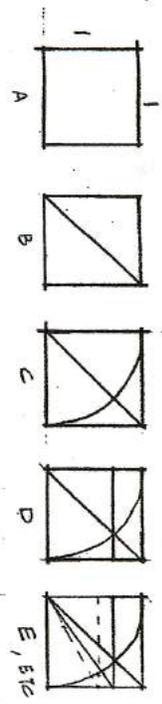
THE TETRAKTYS, THE PERFECT NUMBER TEN (10)
 THE NUMBER OF WISDOM SEVEN (7)
 THE NUMBER FIVE (5)

Plutarch
 7/14/10

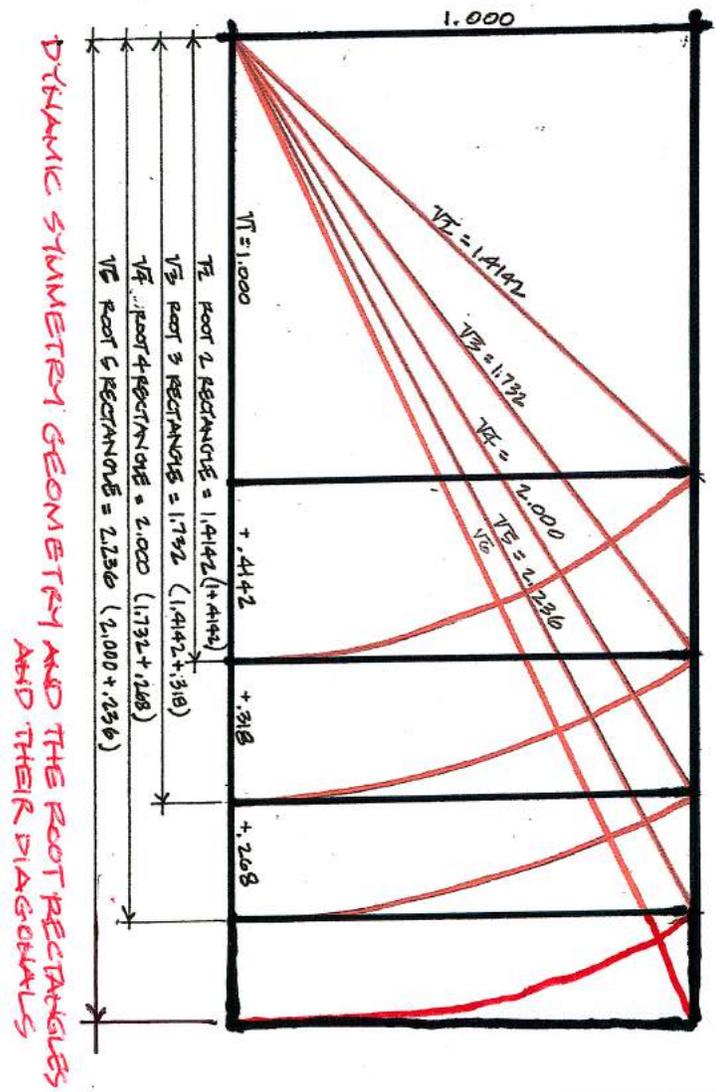
9

10





AB = ... RECTANGLE (SOURCE)
 AG = ... RECTANGLE (ROOT TWO (2) RECTANGLE)
 AI = ... ROOT 3 RECTANGLE
 AK = ... ROOT 4 RECTANGLE (DOUBLE SQUARE)
 AN = ... ROOT 5 RECTANGLE

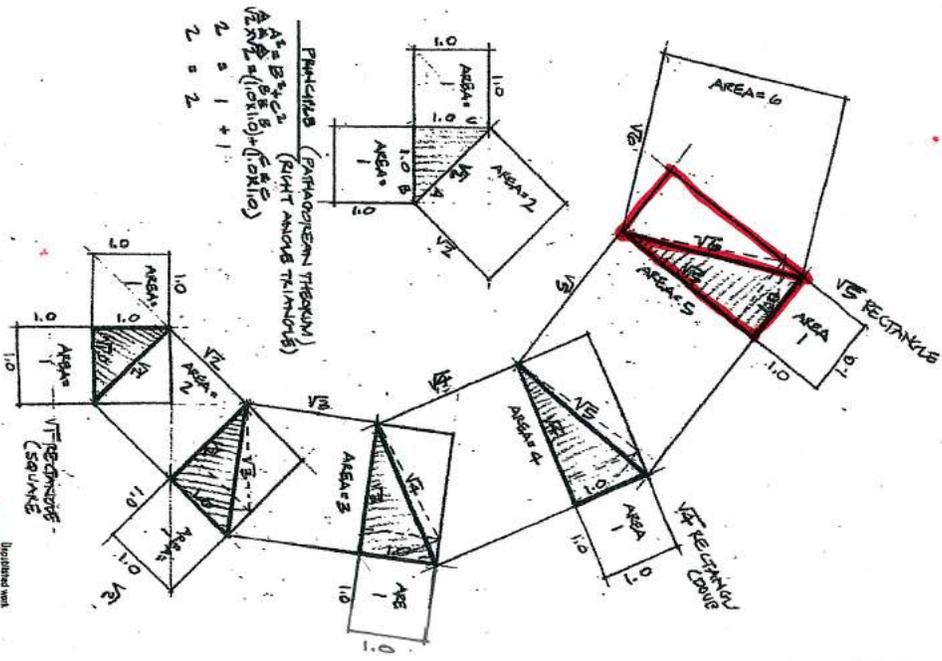
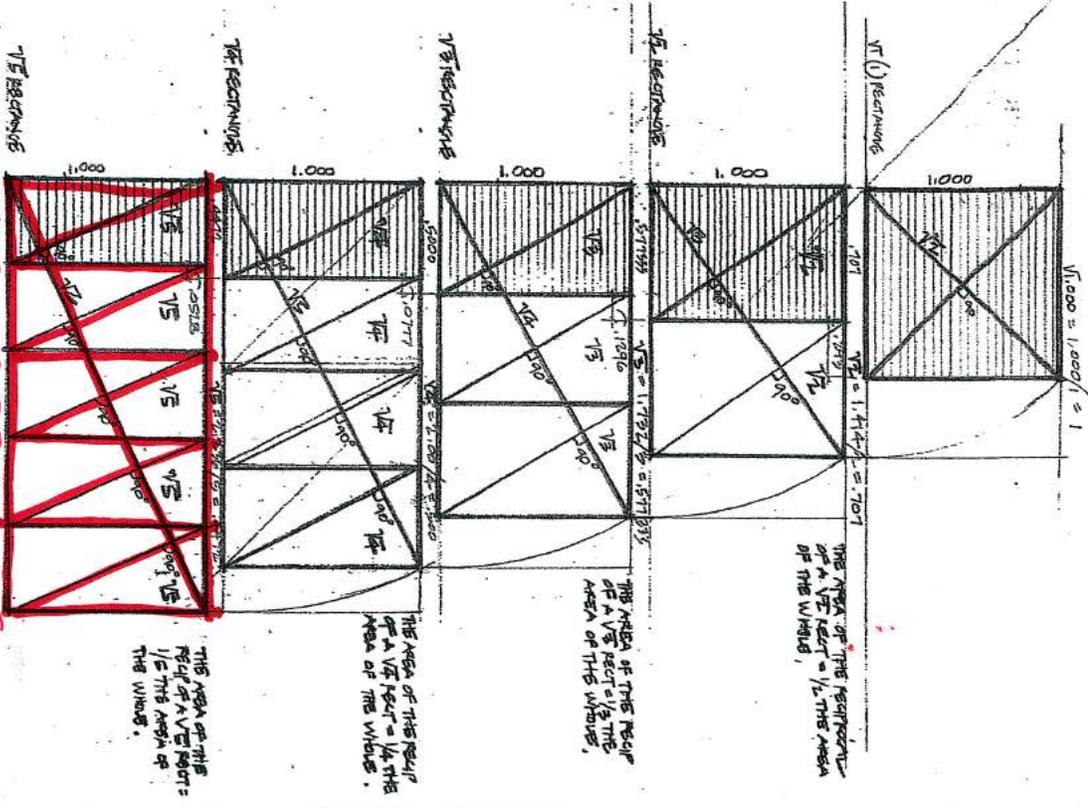


DYNAMIC SYMMETRY GEOMETRY AND THE ROOT RECTANGLES AND THEIR DIAGONALS

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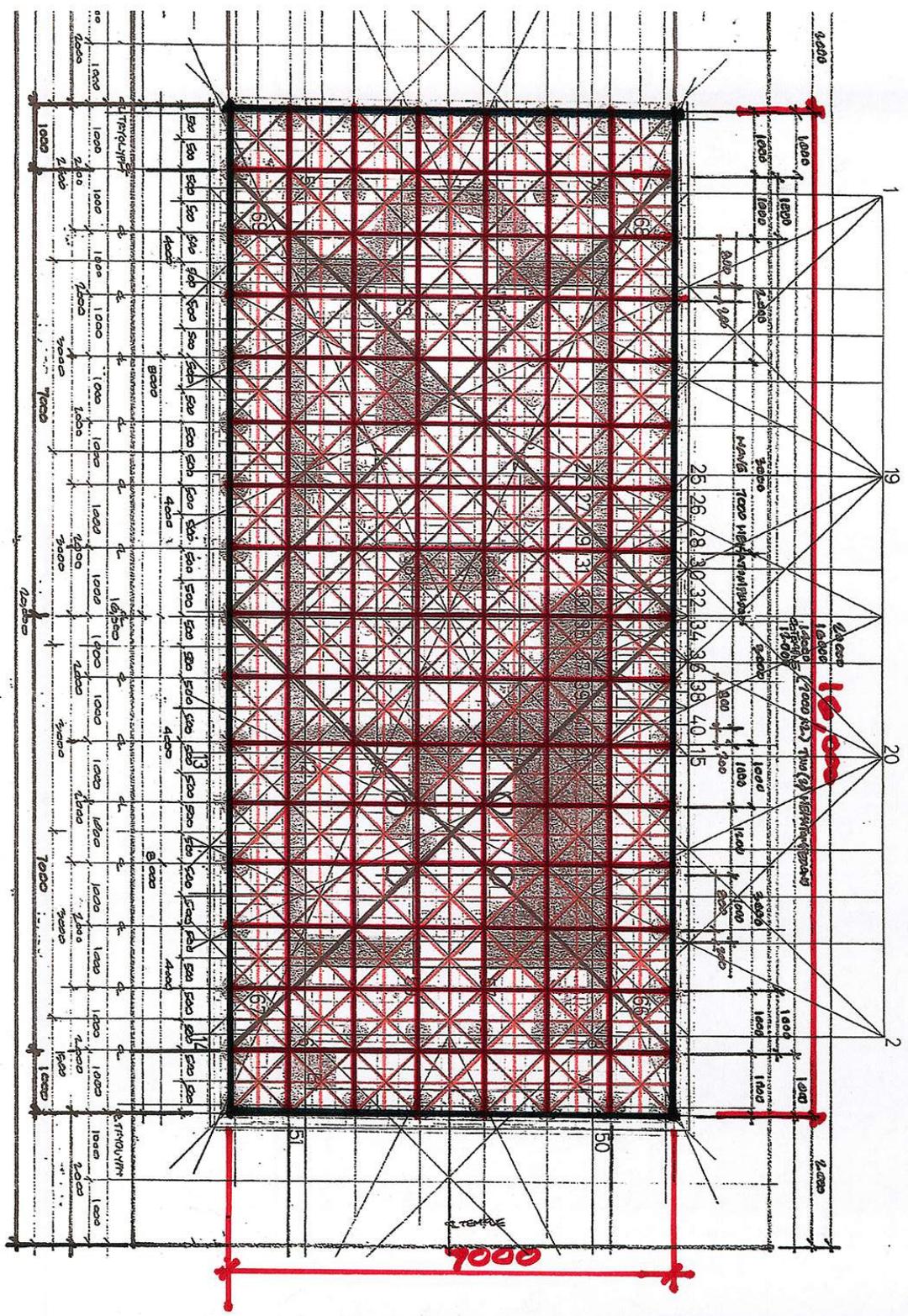
THE ROOT FIVE RECTANGLES
THE RESIPROCAL OF THE INTERRELATED ROOT RECTANGLES

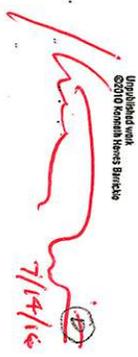


7/13/14

14

THE TRIQUITY GRID PLAN
500 x 500
1000 x 1000

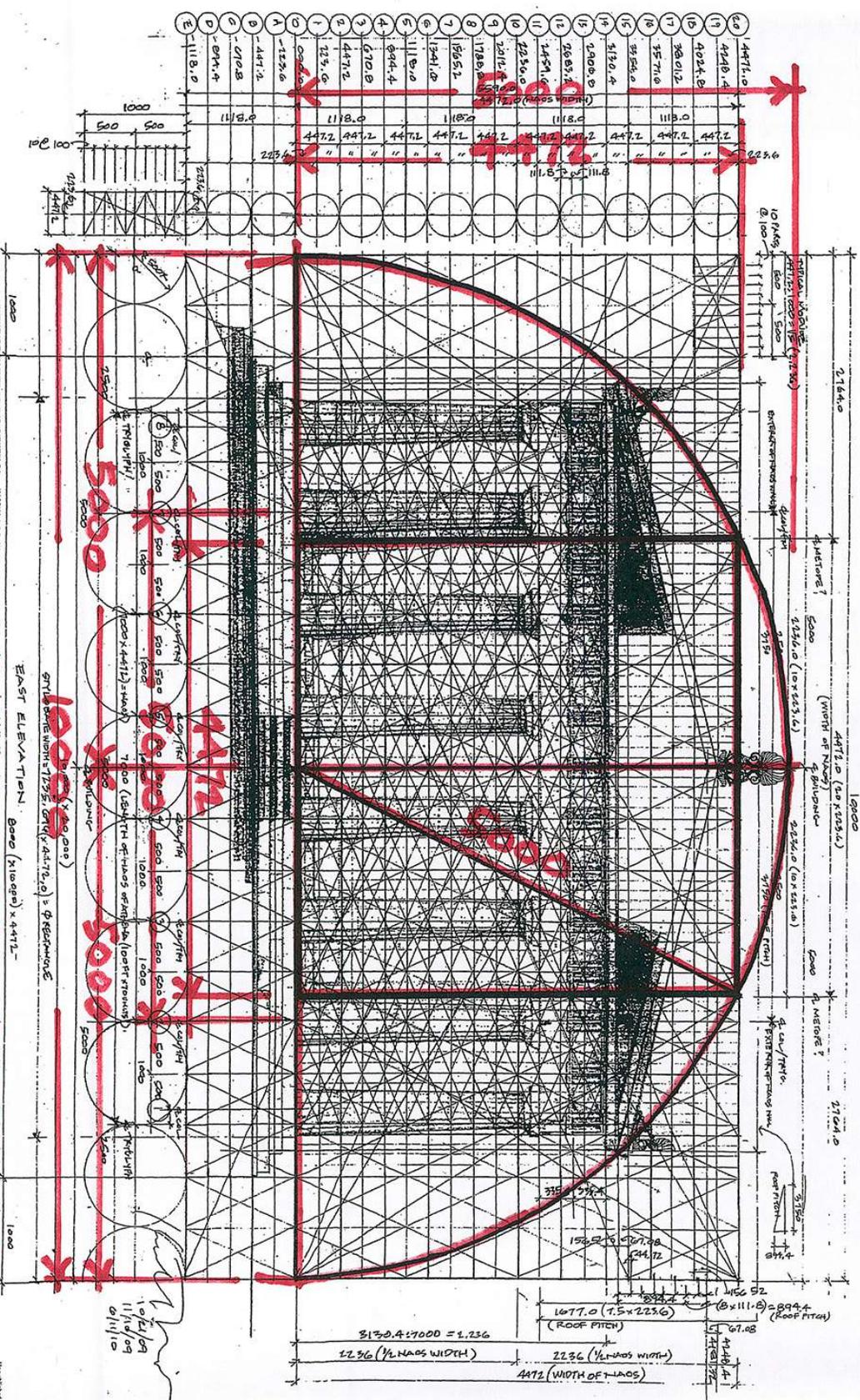



 Unpublished work
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 7/14/10

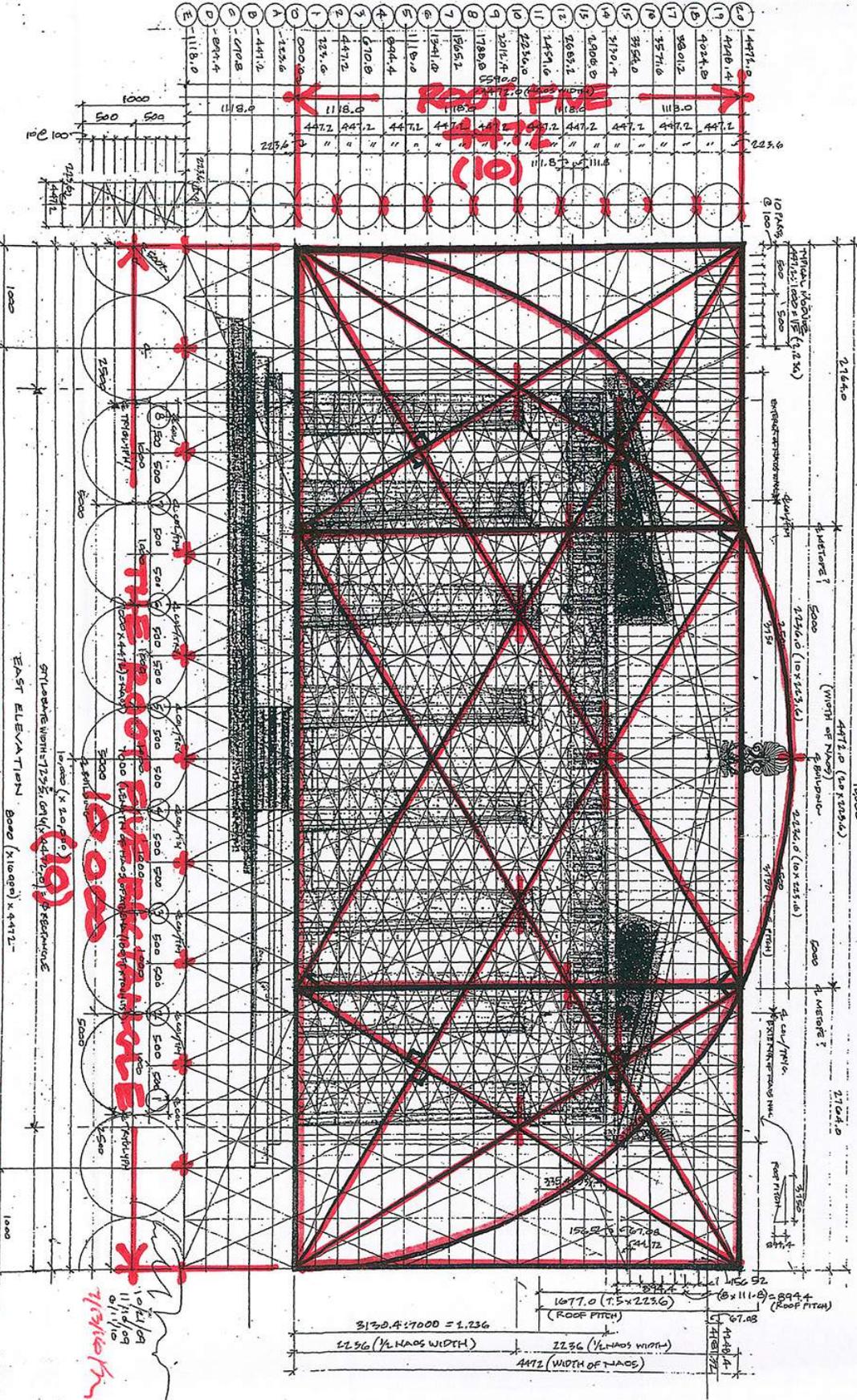
16

THE DIVINE PROPORTION OF THE GOLDEN RECTANGLE

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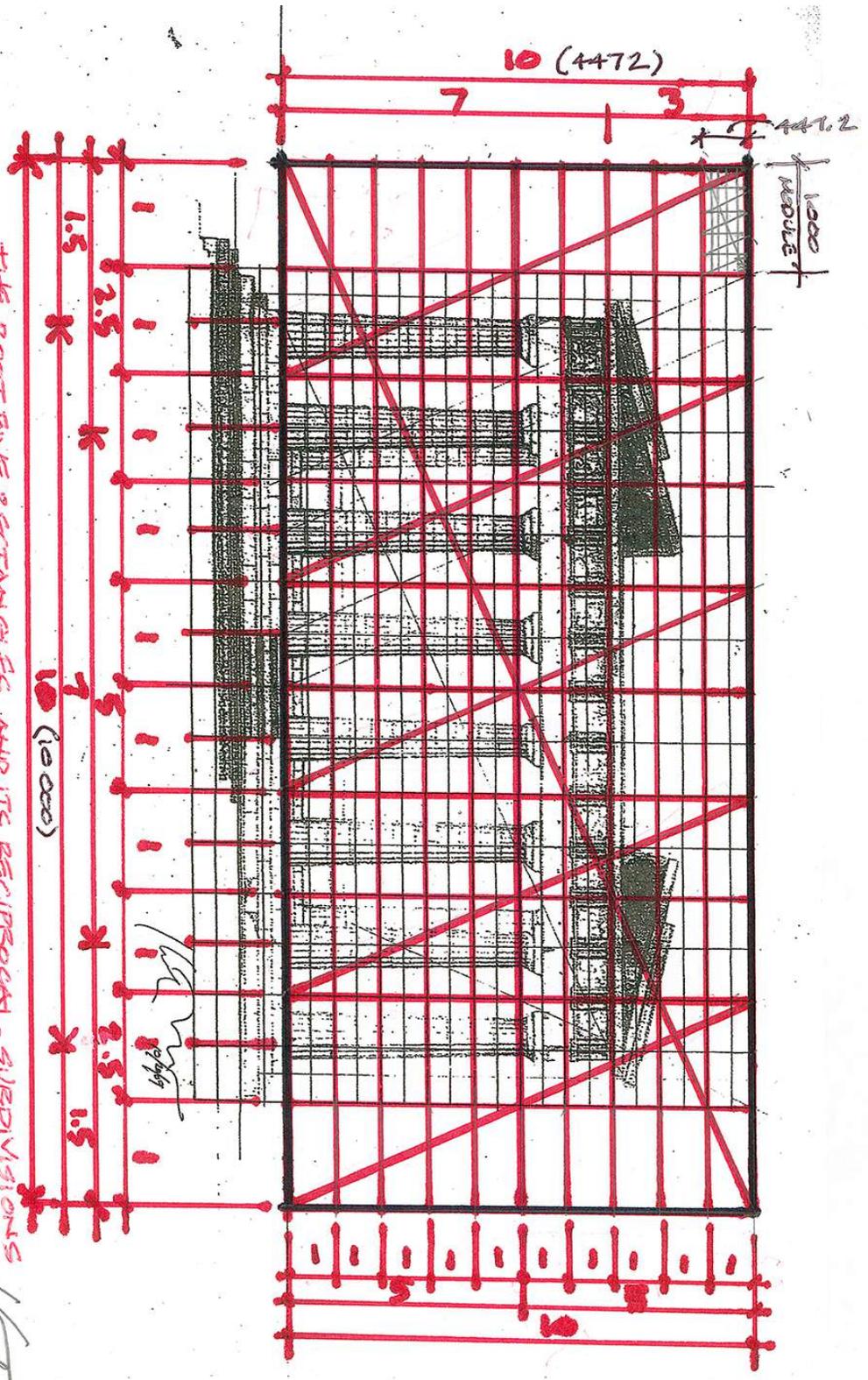


THE GOLDEN RECTANGULAR DIAGONALS IN THE FOOT FIVE RECTANGLE



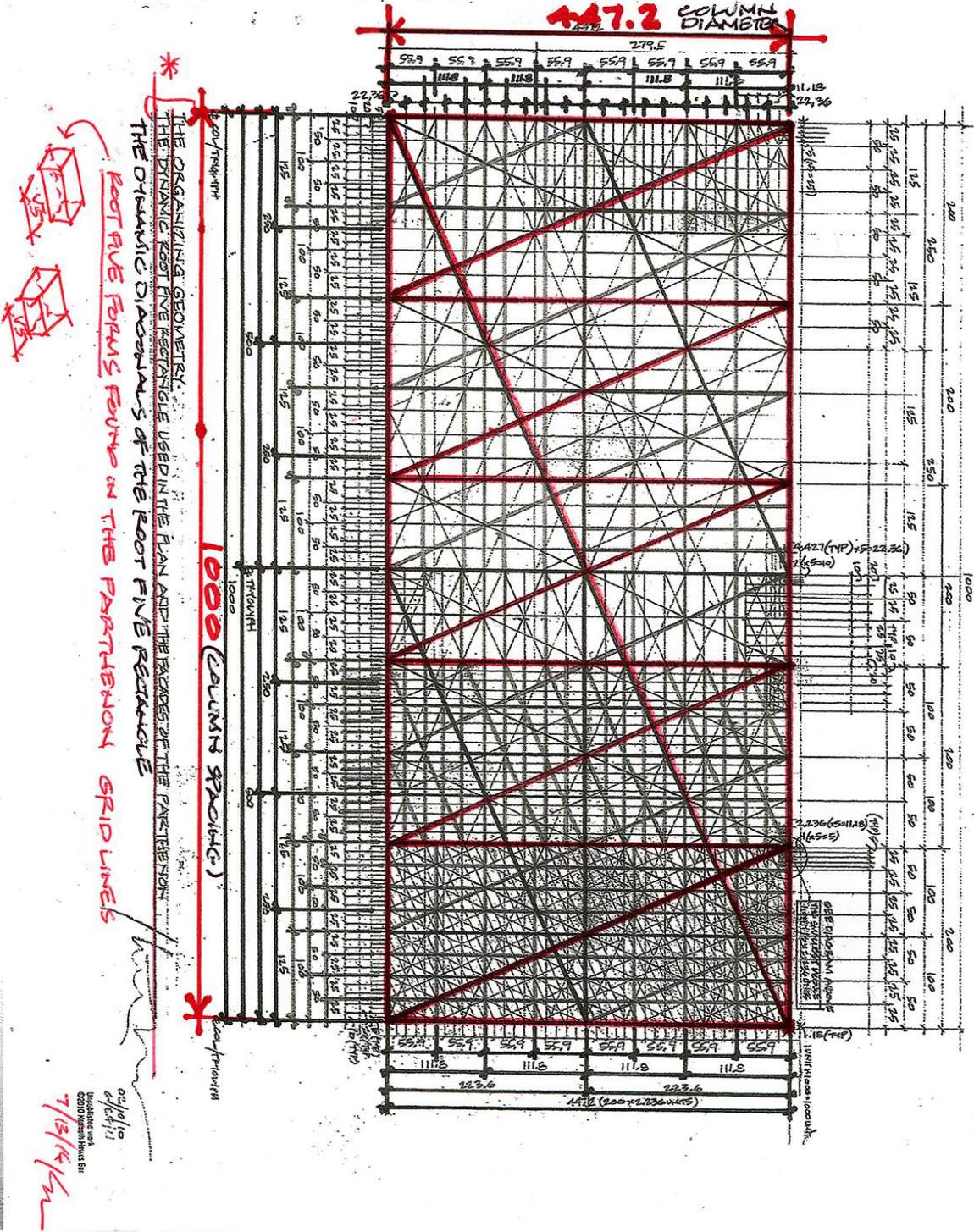
19

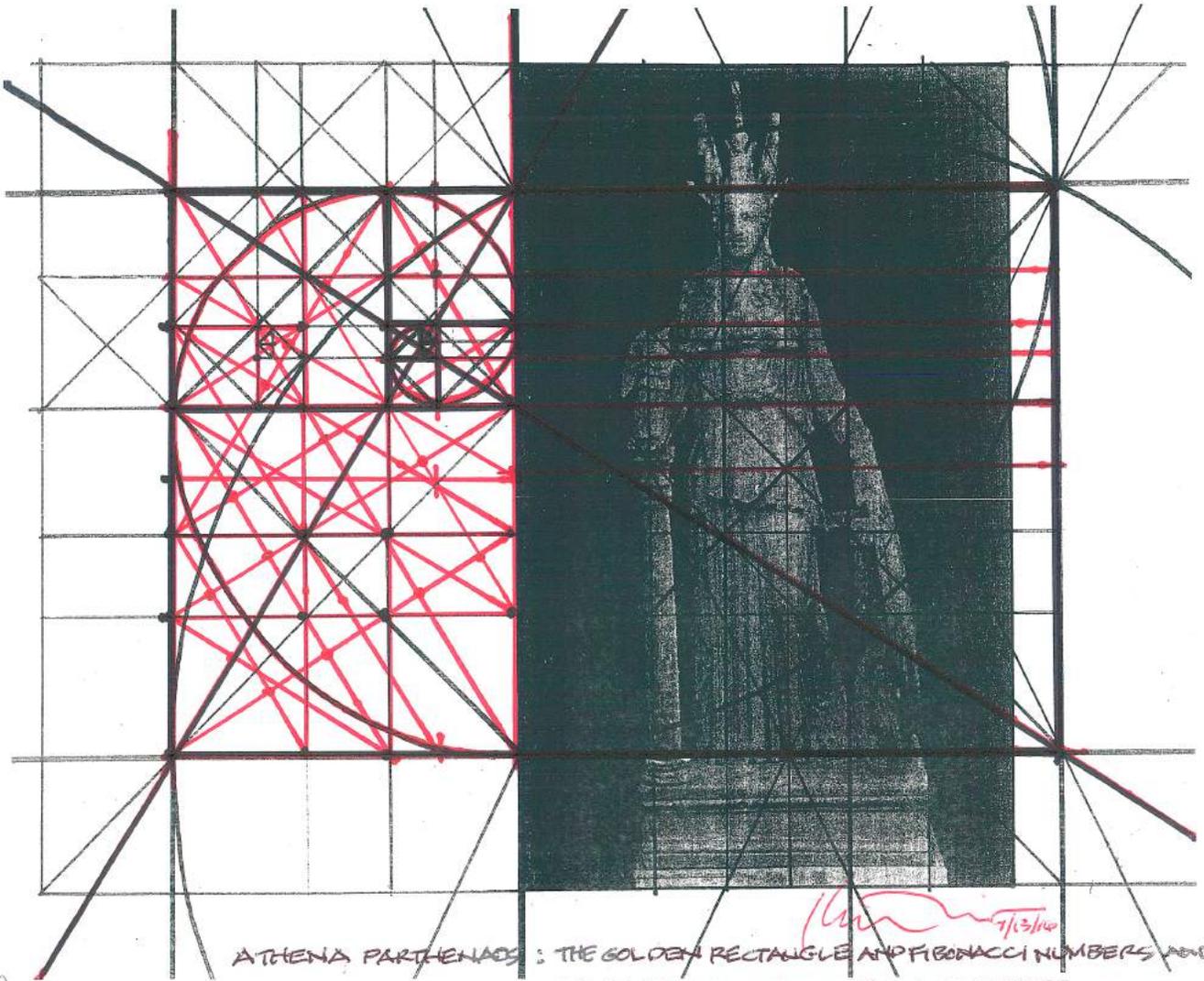
THE ROOT FIVE RECTANGLES AND ITS RECIPROCAL SUBDIVISIONS



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ATHENA PARTHENOS : THE GOLDEN RECTANGLE AND FIBONACCI NUMBERS AND PROPORTIONS USED IN THE SCULPTURES.

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