North Elevation

WOODFOLD VILLA

for Mr. Hussain

SHAW & JAGGER ARCHITECTS

PROPOSED PRIVATE DWELLING

Land Adjacent to Woodfold Park, Blackburn

The Proportion of Classical Architecture

February 2024

About the Author - Francis Shaw

Francis Shaw, the author of this report and designer of Woodfold Villa, possesses demonstrable expertise and competence in the use of the classical orders and the design of a Palladian Country House. He is an architect with 43 years' architectural experience, qualified for 35 years and has worked on a number of scheduled ancient monuments. One of these, Hellifield Peel, was the first to be converted to a private residence post WW2 and was featured on Channel 4's Grand Designs programme. He has also worked on many Grade I listed country houses, including Sundridge Park by John Nash with a Humphrey Repton landscape, and on other historic structures including castles at Mingary and Loudoun in Scotland.

He has designed a series of NPPF Paragraph 84 houses (formerly paragraph 55, 79 and 80) along with Paragraph 139 (formerly paragraph 134) designs. He has successfully guided schemes in World Heritage sites, National Landscapes (formerly AONBs) and listed settings to approval. He has also carried out a series of commissions for new build Palladian/Georgian villas in Yorkshire and the Midlands. Francis's thesis at Bristol University was on Rationalism and the use of the Classical language and, at Edinburgh his MA thesis was on Sacred Geometry. Work from his MA thesis has featured in various publications. He has also written articles for many newspapers including the Sunday Times and his work for Shaw & Jagger Architects has featured in many newspapers, magazines and books.

The Proportion of Classical Architecture

1. The purpose of this report is to establish why the design of Woodfold Villa is an exemplary essay in classical architecture. The design of a Georgian Country Villa has evolved from applying the geometry and mathematics derived from Greek philosophers and mathematicians (Plato's Symposium 1513, Euclid Elements printed in 1482 and The Golden Verses of Pythagoras 1494) and Greek and Roman architecture, primarily from the temple structures or sacred buildings which are predominantly what have survived through over two millennia for architects to study and record their details.

2. Throughout the Middle Ages, many of the great works of the ancients had survived in medieval monastery libraries, copied from ancient texts. Works such as Pythagoras and Vitruvius found favour with Christian theologians, due to the Pythagorean mathematics being limited to whole numbers, that is, definable.

"What is God? He is length, width, height and depth" - St Bernard of Clairvaux

3. The Renaissance in Italy was instrumental in 'rediscovering' and 'rescuing' the knowledge of the ancients. The publishing of these important texts and treaties were the bedrock of the Renaissance, allowing a much wider access to the knowledge of the ancients. Euclid's 'Elements' printed in 1482 established the foundations of geometry that influenced the arts until the early 19th century. The Renaissance 'rescued' the true classical orders from antiquity. The treatise of Vitruvius, a Roman architect and engineer from the first century BC, was the only work on architectural theory to survive from antiquity. Vitruvius's work 'De Architectura' came to prominence when published in Rome in 1486. The work had a profound influence on architects and artists such as Leonardo da Vinci, Michelangelo, Bramante, Vignola and Palladio. The Iconic image of 'Vitruvian man' c1490 is a key to unlocking Vitruvian proportion, including the most successful diagram of 'squaring the circle' yet drawn. Vitruvius stated that all buildings should have three attributes; durability, utility and beauty. He believed that architecture was an imitation of nature. "As birds and bees built their nests, so man built houses from natural materials, that gave them shelter against the elements." He asserted that the Greeks, in perfecting the art of building, had invented the classical orders: Doric, Ionic and Corinthian. It gave them a sense of proportion culminating in an understanding "Beauty is produced by the pleasing appearance and good taste of the whole, and by the dimensions of all the parts being duly proportioned to each other."

4. Of the many Architects influenced by Vitruvius, Andrea Palladio (1508-1580) is regarded as greatest exponent of classical architecture of this period. His Villas, the Villa Almerico Capra Valmarana (better known as the Villa Rotonda in the Province of Vicenza) and the Villa Foscari (better known as the Villa 'La Malcontenta' in the province of Venice), are considered as his architecture masterpieces for domestic architecture. Palladio cemented his influence across Italy and Europe in publishing his 'The Four books of Architecture' in 1570, first published in English, by Leoni between 1715-20. Palladio's Villas and public buildings had a profound effect upon the travelling British aristocracy. Lord Arundel and his party, including the Architect Inigo Jones, visited Italy during 1613-14. Inigo Jones is regarded as the first of the English Palladian Architects, The Queen's House c1616 in Greenwich, being the archetype of the English Palladian style.

5. At the same time of the first English edition of Palladio's 'Four Books of Architecture,' Colen Campbell's 'Vitruvius Britannicus' was published in three volumes 1715, 1717 and 1725. It included the works of Inigo Jones, Christopher Wren, James Gibbs and Colen Campbell. The work introduced Colen Campbell to wider client base with the subsequent editions containing Campbell's major commissions at Stourhead (1724), Wanstead (1720), Mereworth Castle (1725), Houghton Hall (1722) and Burlington House (1717); where Lord Burlington sacked James Gibbs for Colen Campbell. Lord Burlington, Colen Campbell and William Kent are generally regarded as the founders of the English Country House tradition. Burlingtons Chiswick House (Chiswick Villa) and Colen Campbell's Merweworth Castle were both modelled on Palladio's Villa Rotonda. These Villas, along with Campbells designs for Wanstead and Stourhead and Burlington and Kent's Holkham Hall, were instrumental in influencing architects and their patrons into commissioning great houses for what became known as Palladian Architecture.

6. Lord Burlington was one a coterie of aristocratic architects and freemasons, who revelled in the purity and order the Vitruvian principles of Durability (strength and firmness), Utility (Useful throughout the ages), and Beauty (to beautify, delightful conditions) and believed it important that architecture should reflect these principles. As a Freemason, the more intellectual and arcane nature of the geometric proportions contained within Vitruvian man appealed to Burlington and were part of the masonic initiation and levels of masonic degrees. The Masonic greeting 'are you on the square' is derived from this diagram of squaring the circle. The masonic symbol of the angle represents the square, the symbol of earth and the material world. The square in masonic terms represents fairness, balance, and firmness -very close to the Vitruvian attributes. Squaring the circle is a diagram that goes back to the early foundation of the pyramids in Egypt. The Pyramid is drawn from the vertical centre of the circumference with its base formed by the diameter of the circle. The pyramid formed provides the sides of the square, the four corners determined through the centre of the circle. This diagram was closest the ancients had of a geometry that demonstrated achieving the impossible, that is of generating a square of the same area as the circle. This diagram is also used for another more arcane demonstration of proportional geometry. The circle drawn from the centre of the tip of the pyramid, whose radius is to the top of the square, therefore forms a circle that is the same ratio to the larger circle as the moon is to the earth. This diagram can be repeated to show the 'moon' circle to all four points of the axis; north, west, south and east. The diagram appears as part of Tantric Yantra.

7. For Freemasons seeking to talk freely and exchange ideas, without the fear of recrimination, architecture was a means of expressing such knowledge in geometric form. This form of expression goes back to the earliest symbology, in the setting out of stone circles, burial sites, the pyramids, Greek temples though to the medieval cathedrals. The Vitruvian principles held by master masons and the Abbots of the monasteries kept this arcane knowledge alive. Many religious hierarchies have or had their own sacred geometry, that has defined the buildings form and dimensions.

8. The geometry of the renaissance villa and later the Palladian House started off as a mathematical exercise and later to echo the Vitruvian attributes when the inclusion of an arcane proportion system seemed less important. What is significant in the English Palladian tradition is that many took a great interest in architecture and how the building should be laid out and elevated, the buildings geometry and proportion being of the upmost importance. Before this it was the master masons or architects that drove the geometry of the building, such as architects like Robert Smythson or John Thorpe. They used the fashionable compact lodge form to express Vitruvian geometry. It was rare that clients were expressly involved in design of platts (plan), such as Sir Thomas Tresham's Triangular Lodge; in this case it was a building designed to 'hide' Catholic symbolism at a time when Tresham thought that his world might be obliterated forever. Freemasonry became a forum for free expression with a set of rules in which to communicate must have been for an enlightened audience seeking advancement and knowledge and so 18th century Freemasonry became fashionable where the demonstration of architectural prowess became a means of communication to your peers that you were educated and sophisticated man.

9. The setting out of the Palladian Country house relies on a series of geometrical forms, at the core of the design is the platt or plan of the house. In the early 18th century it was paramount that the setting out of the houses reflected a purist geometry derived from such diagrams as the Vitruvian man, the squaring the circle. Most patrons would have had a 'classical education' to some level. Certainly enough to understand the importance of geometry and number to such ancient Philosophers as Plato. Plato considered geometry and number as the most reduced and essential, and therefore the ideal, philosophical language.

"And do you not know that they (the geometers) make use of the visible forms and talk about them, though they are not of them but of those things of which they are a likeness, pursuing their inquiry for the sake of the square as such and the diagonal as such, and not for the sake of the image of it which they draw? And so on in all cases… What they really seek is to get sight of those realities which can be seen only by the mind" - PLATO, Republic. VII. 510 d, e.

The Platonist sees geometrical knowledge as being innate within us, having been acquired before birth, when our souls were in contact with the realm of the ideal being - as such the 18th century architect, equipped with square, a compass, a worn copy of Euclid Elements and Palladio's 'Four Books on Architecture,' had all what was needed to create the great work.

The setting out the plan, as stated earlier, would have been a purist exercise in geometry in the early 18th century. The platts of Buildings such as the Villa Rotonda had more in common with religious buildings, due to the simple cross form based upon 'squaring the circle.'

Whilst Burlington's Chiswick House was widely admired for its design and William Kent's interiors, the general view was that it was too small to live in, with no rooms large enough to entertain. As such, many country house layouts in the later 18th century departed from the strict geometrical plan forms; although symmetry still dominated the plan forms up until the early nineteenth century. The influence of Humphry Repton was considerable, he was instrumental in changing the design of principal reception rooms bringing the living accommodation down from the 'Piano Nobile' (the Noble first floor) down to ground floor; allowing access to the garden. As such the orientation of the design changed to allow the layout to best effect views and daylight. Loggia's were introduced, as his design at Sheringham and more informal or asymmetric design adopted; as such the need for symmetry was consequently abandoned although the principal elevations were still set out to traditional proportions.

The following methodologies of proportion systems have been used throughout the ages. Each method for setting out the geometry generates the proportions used in classical design and architecture. Most architects have used the germination of lines and angles from the Vitruvian man in order to design a Palladian style villa since the 16th century and currently a combination of the various methods below;

Geometry means 'measure of the earth'

The geometry and proportion systems used in setting out were a composite overlay of the vesica, squaring the circle, the canon (Pythagorean numbers), the golden section, and the Pyramid squaring the Circle and Rabatment (the rule of three). All of these geometries are combined in the diagram of the Vitruvian ideal, shown in Leonardo de Vinci's Vitruvian man. FIG 1

The Vesica Piscis: The Mandrola; the renewing of life

The Vesica Piscis in the Christian geometrical canon is a representation of Christ as the conscious human form (i.e. now) balancing out the eternal (heaven) and ephemeral (earth). The Piscis means the 'bladder of the fish,' the Greeks and Romans believed the Vesica Piscis was a token of fecundity, of renewal of life; Venus arising reborn from the waves. In Christian symbolism it is that of Christ reborn. The Vesica is the starting point to proving a series of geometrical exercises that are staging points to the golden section. First, establishing the geometrical proof of 'the root of 3' and followed by 'the root of 5.' The use of these diagrams helps establish the basic tools to enable drawing the proportions of the portico. FIG 2, 3, 4, 5 & 6

Squaring the Circle: The marriage of heaven and earth

The circle is the shape traditionally assigned to the Heavens, and the Square to the Earth. When these two shapes are unified by being made equal in area or perimeter we speak of 'squaring the circle', meaning that Heaven and Earth, or Spirit and Matter, are symbolically combined or married. This symbolic marriage is illustrated by the small circle fitting above the Vitruvian man's head between the large circle and the square.

The proportions of the small circle to the large circle of that of the Moon to the Earth (this can be more easily achieved using the method of the pyramid squaring the circle) in a simple ratio the circles are at a ratio of 3:11

The Marriage of Heaven and Earth is best symbolised by a rainbow The diagram of squaring the circle, can be used to show the rainbow as a representation of this proportionally, the outer circle of the rainbow forms the outer circle and the inner circumference of the rainbow, that formed by a circle within the square. FIG 7 & 8

The Canon: The numbers of Heaven and Earth (Pythagorean numbers)

The squaring of the circle in the ratio of 3:11 is symbolised or represented in many church layouts or doors. The sun takes 33 years (3 x 11) for a perfect repeat sunrise on the horizon. Jesus dies and is resurrected aged 33. Ramadan occurs every 12 moons and takes 33 years to move around the calendar. The Canon is a whole numerical system based upon symbolism number and measure. This is best illustrated by the use of representational numbers for length and width. This was used to set out churches using the Latin or Greek name for the saint, ascribing a value to the name made up from the numerical value from the alphabet.

Underpinning this canonical structure are the series of whole numbers. Half way between 3 and 11 is 7, where 11/7 is the ancient Egyptian value for half of pi, so a circle radius r has a quadrant arc 11/7 r. The Sand Reckoners diagram (Greek: Psammites and Latin ; Arenarius) a work by Archimedes, sets out to discover the number of grains of sand that fit into the universe. By using the diagram, a square's edge may be exactly divided into 3,4,5 and above, 7 and 11 parts. The initial lines produce a series of whole number lengths, areas, and shapes, including a multitude of Pythagorean 3-4-5 triangles of various scales. FIG 9, 10 & 11

The Pyramid Squaring the Circle and Phi

The Great Pyramid of Giza, in Egypt, is probably the most famous structure or geometric object on earth. As one of the of the seven wonders of the World, it has defined human endeavour for millennia. It is therefore not surprising that the geometry of the Pyramid has taken centre stage to all things esoteric, including architectural symbolism. The key facts about the geometry of the Great Pyramid are as follows;

1. The 51.85 degrees slope of the Great Pyramid means the square of its height produces and area equal to each face. Symbolically this is represented as a map of the earth is equal to each face of the pyramid.
2. The Golden Section in the pyramid, Phi = 1.618
3. Pi in the pyramid. Pi defines the ratio between the circle's circumference and its diameter (3.14159…)
4. The Pyramid Squaring the Circle : The Circumference of a circle on height = the perimeter of the pyramid base
5. A Pentagram defining a 'net' for a pyramid : a folded shape

The angle of slope 51.85 degrees (51 degrees, 51 minutes) is a close approximation to 1/7th of a circle, 51.43 degrees. Geometry means 'Measure of the Earth'. The Pyramid functions as an accurate sundial, observatory, surveyors tool and repository for standard weights and measures. Its Perimeter is exactly half a minute of equatorial latitude. FIG 12 & 13

Halflings and Thirdlings

An equilateral triangle or two nested squares both achieve the same geometrical objective; the circle within each of these figures is exactly half the size of the surrounding circle. This is a geometrical image of the musical octave, where a string-length or frequency is halved or doubled. A Pythagorean progression. FIG 14, 15, 16 & 17

The Golden Section

A pentagram inside a pentagram is shown in diagram, Fig 13. In the diagram pairs of lines are highlighted. The length of each pair of lines is a golden section ratio, 1: phi where phi can be either 0.618 or 1.618. Phi divides a line so that the ratio of the lesser part to the greater part is the same as the ratio of the greater part to the whole. No other proportion behaves so elegantly around unity. For example 1 divided by 1.618 equals 0.618 and 1.618 x 1.618 equals 2.618. So Phi minus Phi equals one, and Phi x Phi is one plus Phi !

The Gold Section is one of three simple proportions found in early polygons; Square, Pentagram and Hexagon. With edge-lengths of 1, a square produces an internal dimension of the 'root of 2,' a pentagram 1.618 (Phi), and a hexagon 'the root of 3.' Although the 'root 2' and 'root 3' are found widely in nature, Phi appears predominantly in organic life and only rarely in the mineral world. These proportions are employed in good design. Many familiar objects such as credit cards and Georgian front doors are Phi rectangles.

Pythagorean Number progressions such as the Fibonacci series: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144… (adding the last two numbers to get the next) increasingly approximate to Phi.

A golden section rectangle, widely used in architecture, is constructed from the midpoint of the side of the square to the corner of the opposite side. The angle then forms a radius, the resulting arc, to the base of the forms a rectangle with a side to the value of Phi, creating the golden section. FIG 4, 5, 7, 12 & 13

The Pentagram

The methodology of constructing a Pentagram is taken from the Almagest (a mathematical and astronomical treatise) of Ptolemy c150 AD. The pentagram is formed within a circle. The circle in the case of designing the porch defines the height of the pediment from the column base. If a line is drawn connecting the top two corners of the pentagram, this line then forms the base of the entablature. In constructing the pentagram

the vertical and horizontal axis are used to constructed the form with a series of arcs. The axis are used to form vesica's within the circle. The vertical lines drawn from the intersection of the vesica forms the mid-point of the column bays to set out the fenestration. FIG 5, 12, 13 & 18

Rabatment

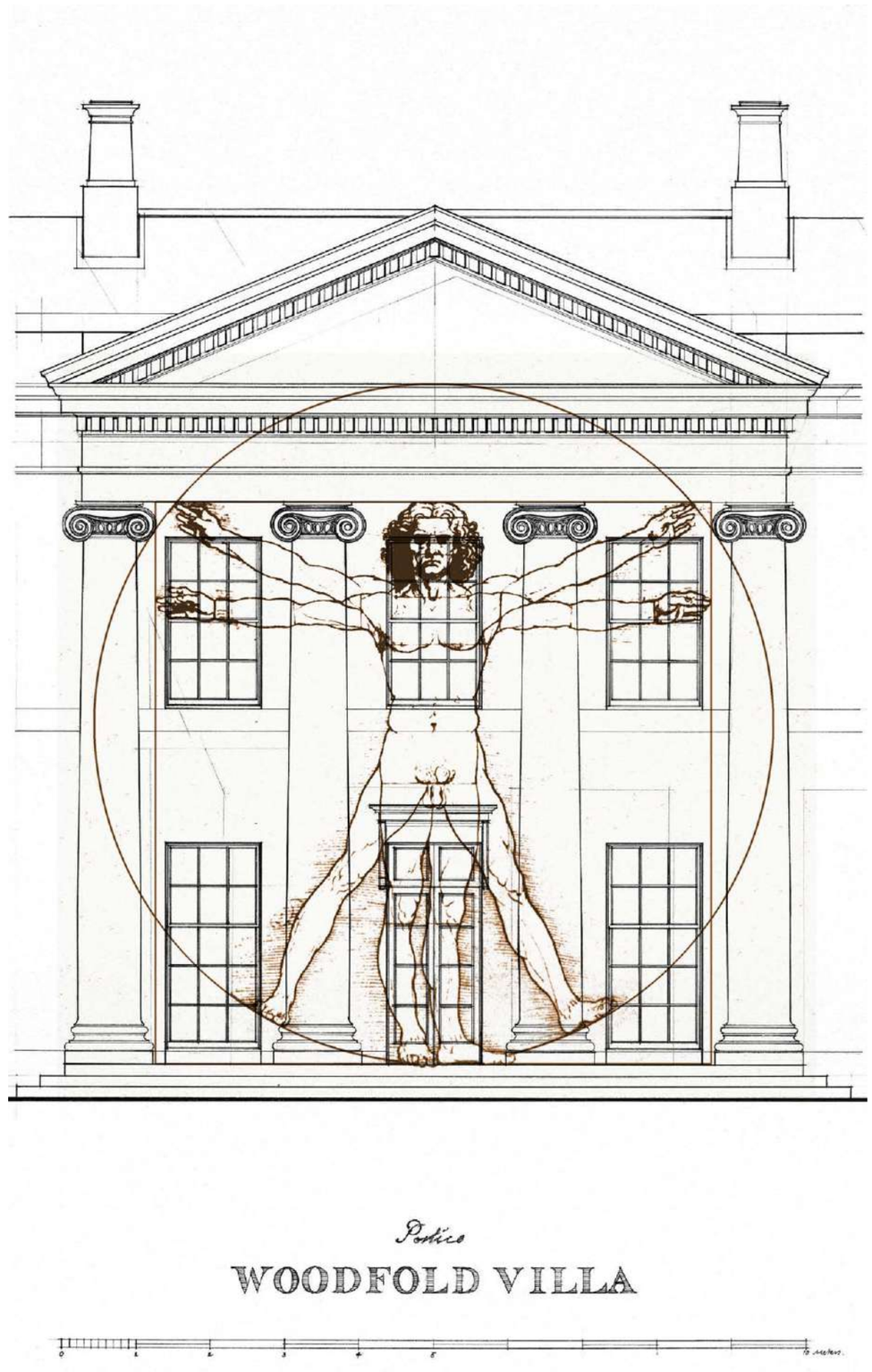
Artists traditionally often used the 'the rule of three' to give balance to their paintings. This approach to setting out the design of a piece is most likely to have originated from the iconography of triptychs in representations of Christ or Mary attended by saints and local dignitaries. Greek architecture (and to a lesser extent Roman), depended less on pure symmetry; Temple design was 'all portico.' In Greek Architecture, a portico was often set on a key religious path or asymmetrically in a wall or building frontage. The influence of Vitruvius through the Renaissance interpretations of the designs of the ancients, i.e. Pliny's Villa led to a purist symmetry. This was driven by both the religious cannon of design, a priori truths and influence of rationalist philosophy from Plato, through Descartes, Spinoza, Kant and Laugier. As such symmetry represented purity in design, a representation of truth. Therefore the country house, in whatever form, would have a central portico with wings either side. Only in the early 19th century were these design strictures loosened. In painting as architecture, the artist would divide their canvas in three, either as squares or rectangles or a mix of both. A successful building, according to the Modernist architect Mies Van der Rohe, "should have a base, a middle and a top." In the case of a Palladian Country House, this is a plinth, floors (perhaps a Piano Nobile) and a cornice or entablature. As such, the composition is divided into nine rectilinear shapes. In setting out the elevation, the initial spaces have a central square form flanked by two rectangles formed from the angle of the Great Pyramid of Giza. FIG 19

Germination

The architectural term germination comes from the germination of seeds, which grow proportionally to the golden mean. In architecture, germination is used in relation to generating the geometry from the base proportion grid or system. Having generated the primary forms, germination is an overlay of complementary angles that form the lines and intersections setting out the entablature, windows and proportions of details. Leonardo's Vitruvian man is set out anthropometrically in "symmetrical" form to create the ideal man. This is taken from the modular measurements of Vitruvius. The germination from the proportions of the Vitruvian man start from squaring the circle through the established geometry to Vitruvius' modules. These modules were based upon the proportion of the human body and Vitruvius' modulisation of the orders. The latter Vitruvius conveniently fails to explain, this is because traditionally columns vary in proportion, in the three orders: Doric, Ionic and Corinthian. The proportions of the columns are based on multiples of the diameter of the column above the column base. Vitruvius called these modules the 'Vitruvian Idéae,' he set temples into a modular grid to enable him to link the modularisation of the ideal man to that of building. This is problematic because the Ancients, The Egyptians, Greeks and Early Romans used columns with various proportions, ranging from the early Doric being seven (column diameters in height) later seven and half to eight. The Ionic are eight and a half to nine and Corinthian are ten diameters. This, therefore, means a design cannot be sensibly generated from the column alone, and the geometry of setting out is paramount. Once the generic proportions have been established the column height is a given and the proportion of the orders established.

Conclusion

The purpose of this report, as stated, is to set out the ways in which the design of Woodfold Villa has been based upon a mature and detailed understanding of a rich tradition of classical architecture, the proportion systems used, explaining their derivation and origin. The design process based on and reflects a thorough understanding of the traditional methodology of setting out and designing a Palladian Villa or Country House and an appreciation of the evolution of this form. That design process, therefore, shows that the design of Woodfold Villa is an exemplary design, drawing on an extremely rich cultural heritage and tradition, and represnts an essay and modern expression of the principles of classical architecture and is anything but a pastiche design. It is intended to reflect long-established and deep-rooted architectural principles that derive from antiquity, were rediscovered in the Renaissance and have continued to inform architecture and the highest standards of design into the modern times.



The Vitruvian man

Figure 1

The Vesica Piscis: forming the √3 rectangle

Figure 2

Vesica: rotated

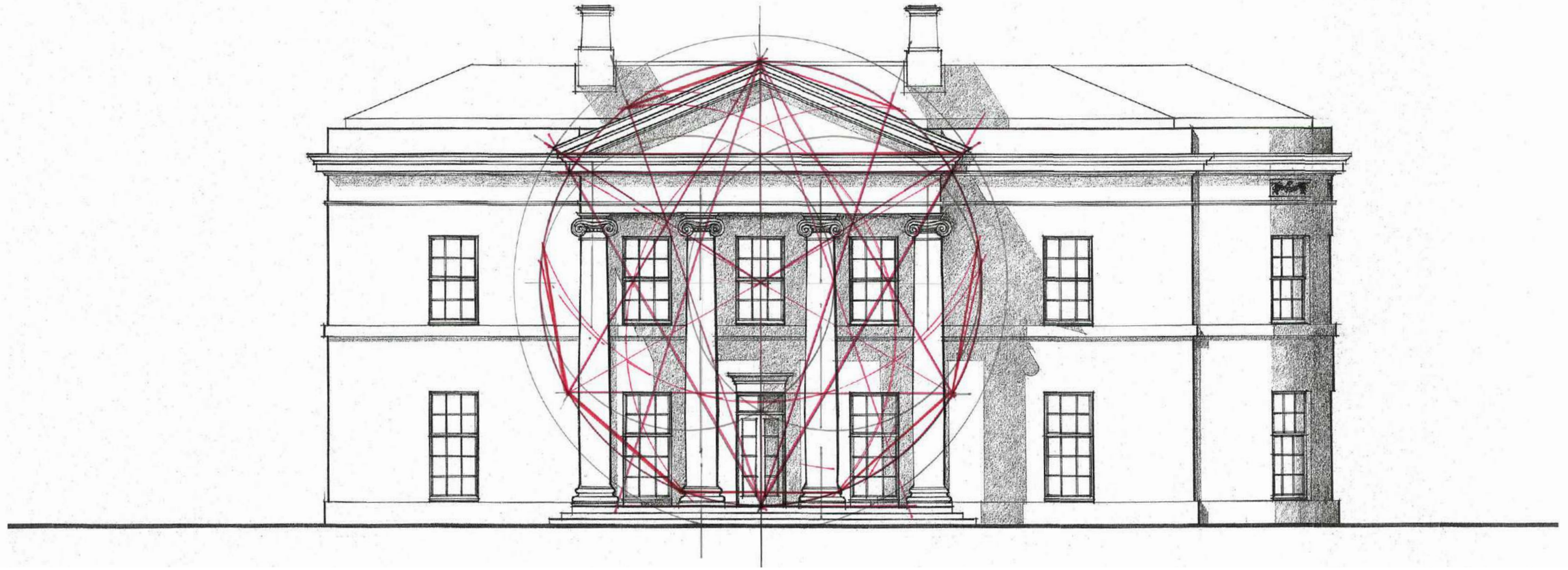
Figure 3

Vesica Piscis to generate the √3 rectangle and the √5 angle

Figure 4

Pentagon & Vesica Piscis

Figure 5

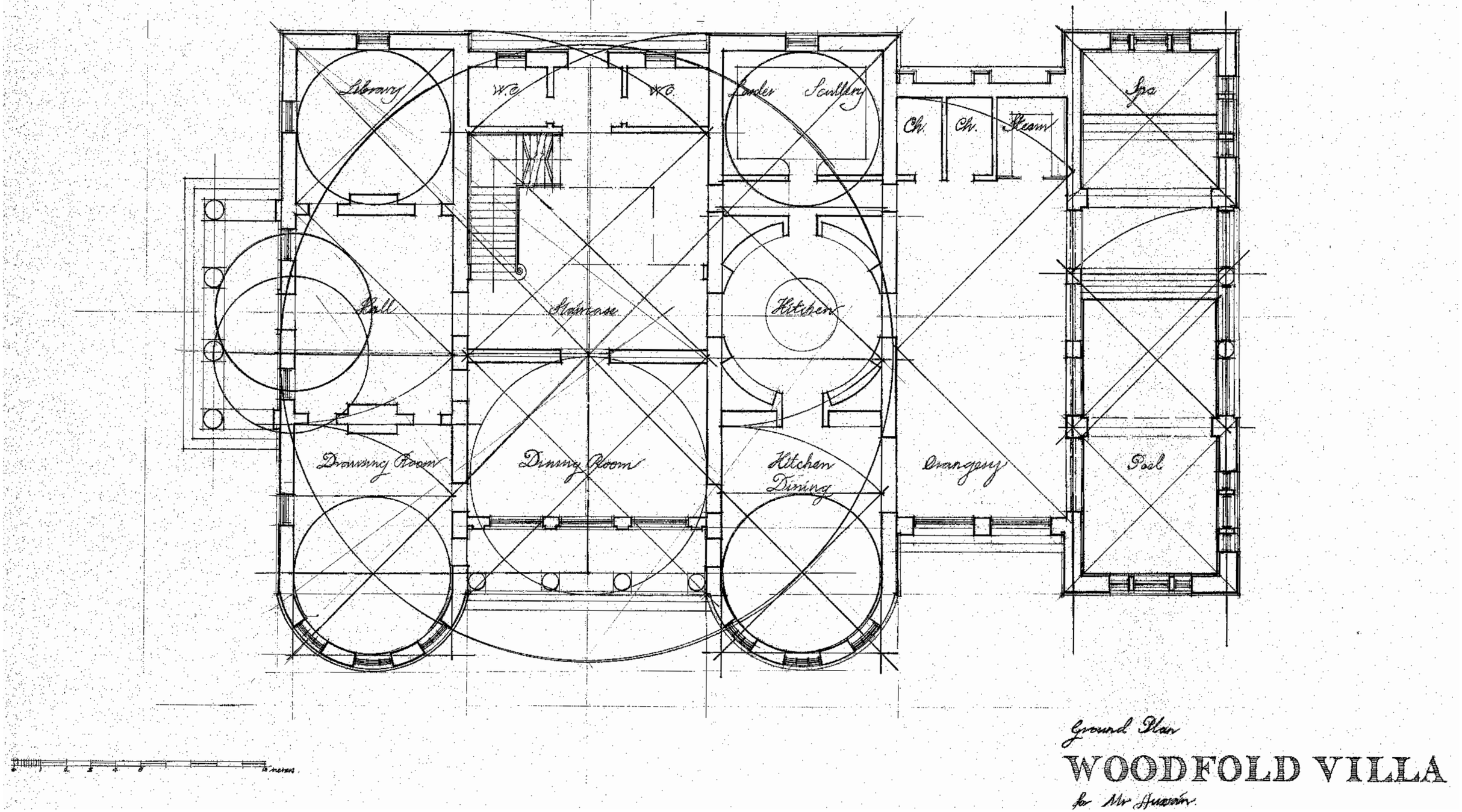


6-sided star (Solomon's seal) and the Vesica Piscis

Figure 6

Squaring the circle and pyramid

Figure 7



Geometry of the plan: Squaring the circle

Figure 8

The Canon: The Sand Reckoners diagram
(within the grids of the portico)

Figure 9

The Sand Reckoners diagram
(the portico square)

Figure 10

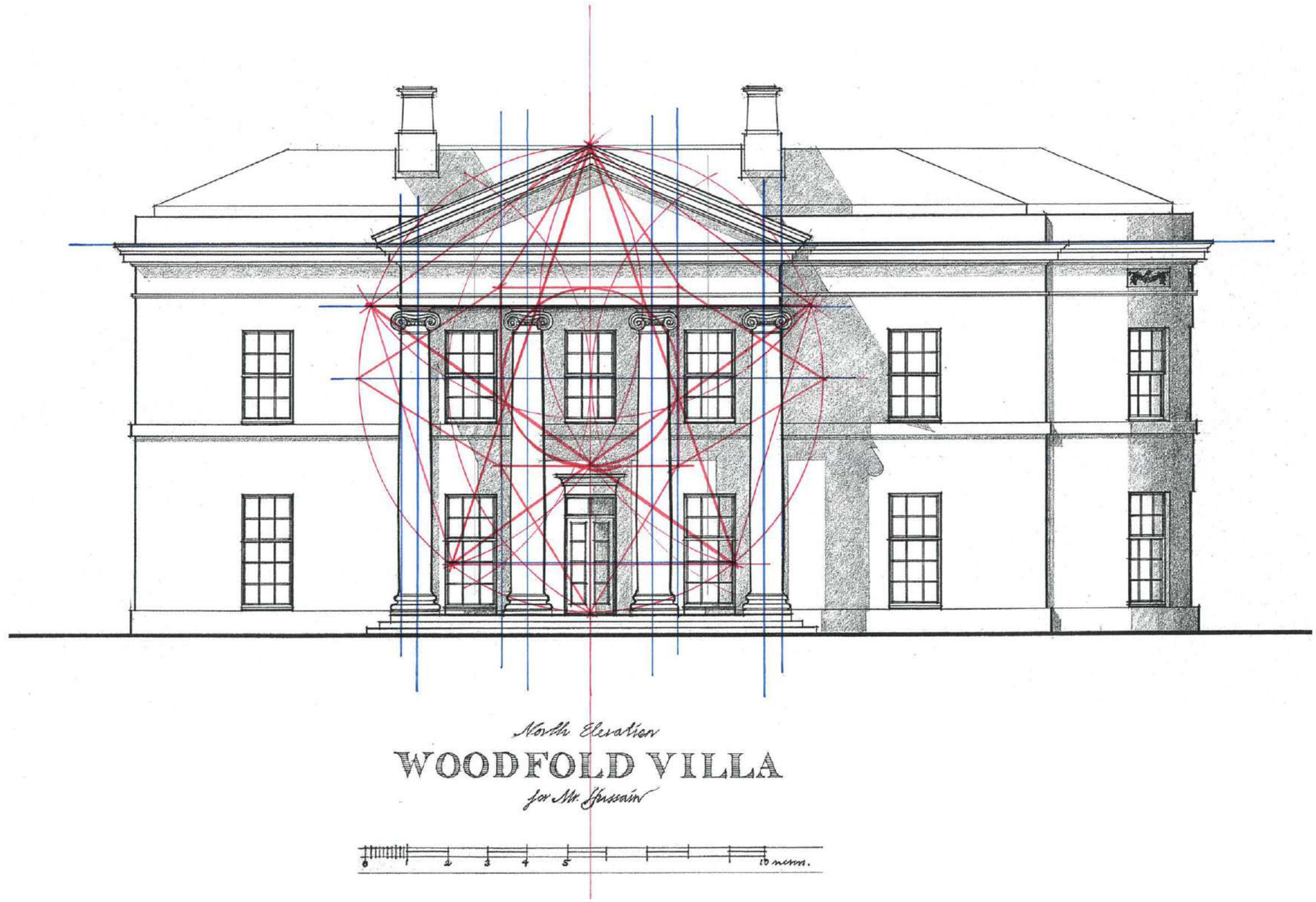
Generation of intervals from the hexagon

Figure 11

fig 12

The Golden Section. Five star pentagon & four-fold vesica piscis

Figure 12

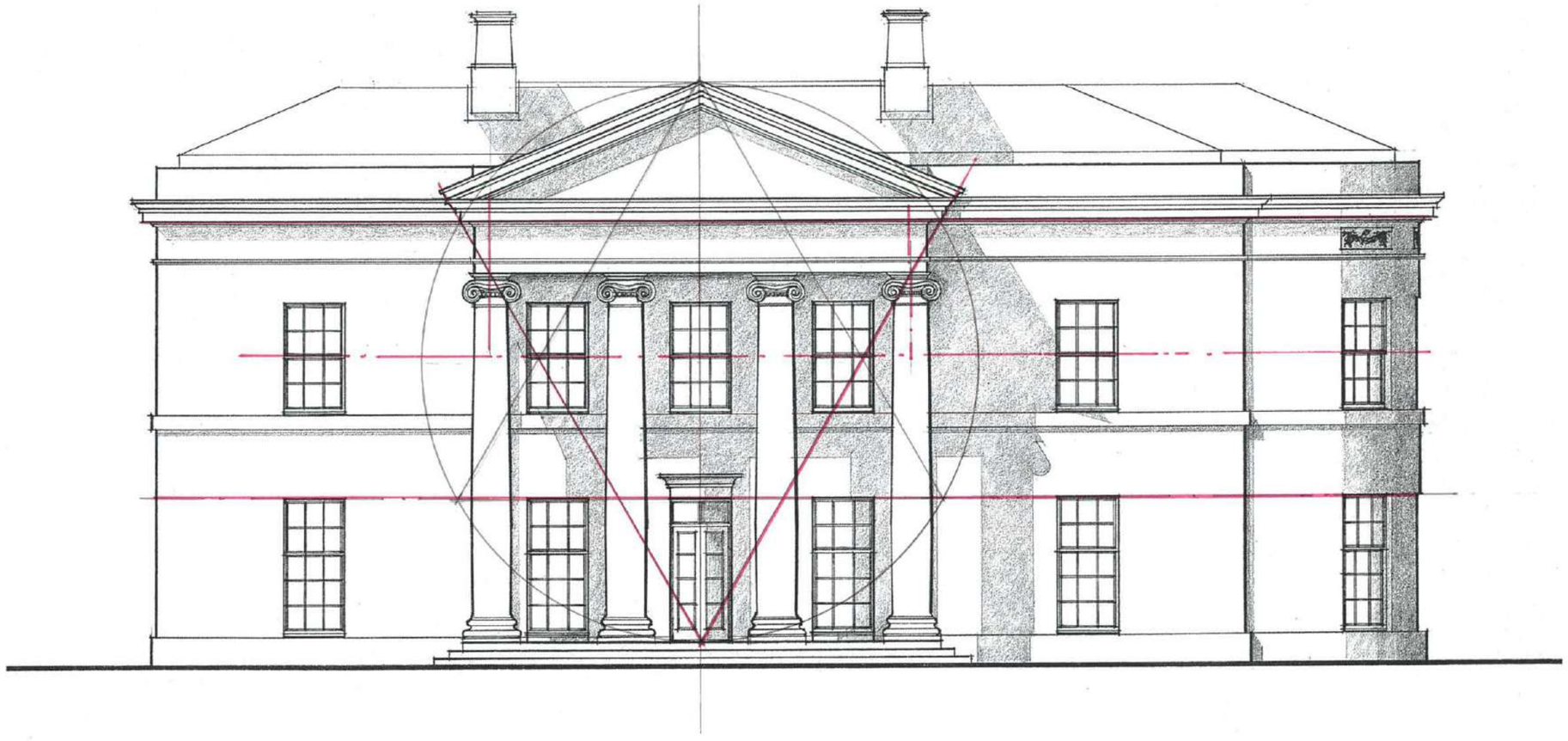


Constructing a pyramid net from a pentagon

Figure 13

Pythagorean intervals

Figure 14



Six sided star: Soloman's Seal

Figure 15

The geometry of an Ennagon

Figure 16

The geometry of an Ennagon

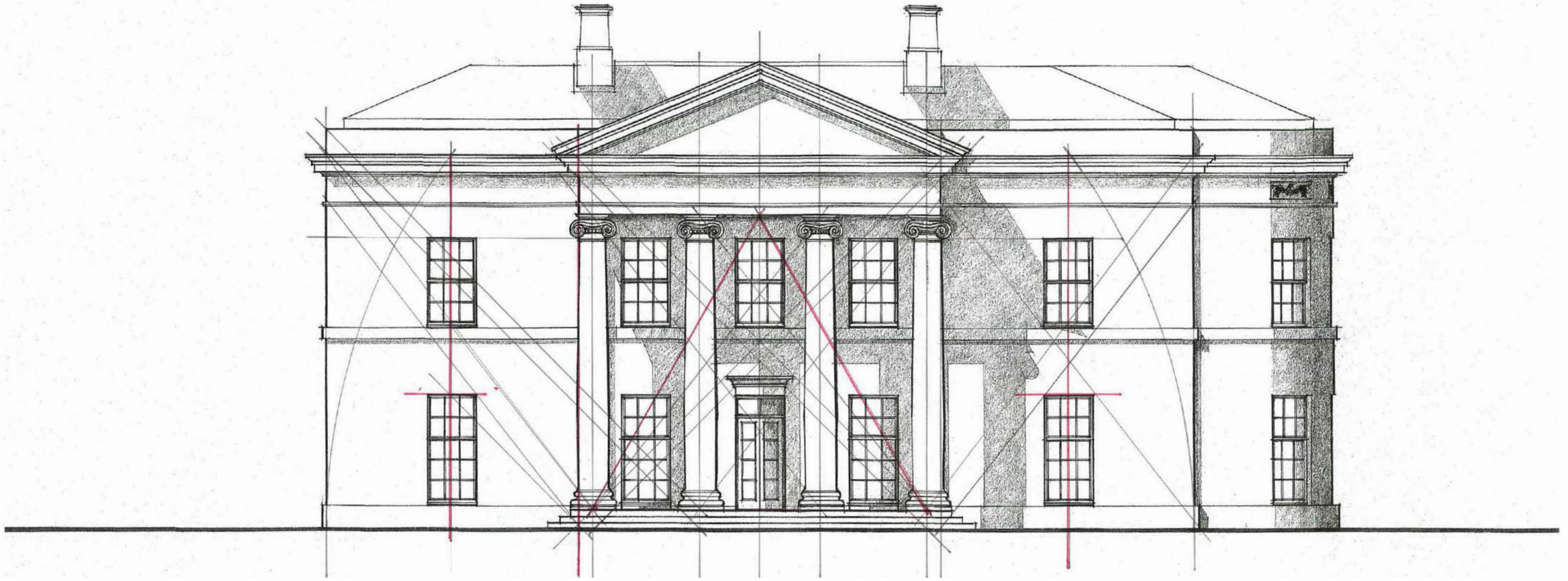
Figure 17

Constructing a pentagram

Figure 18

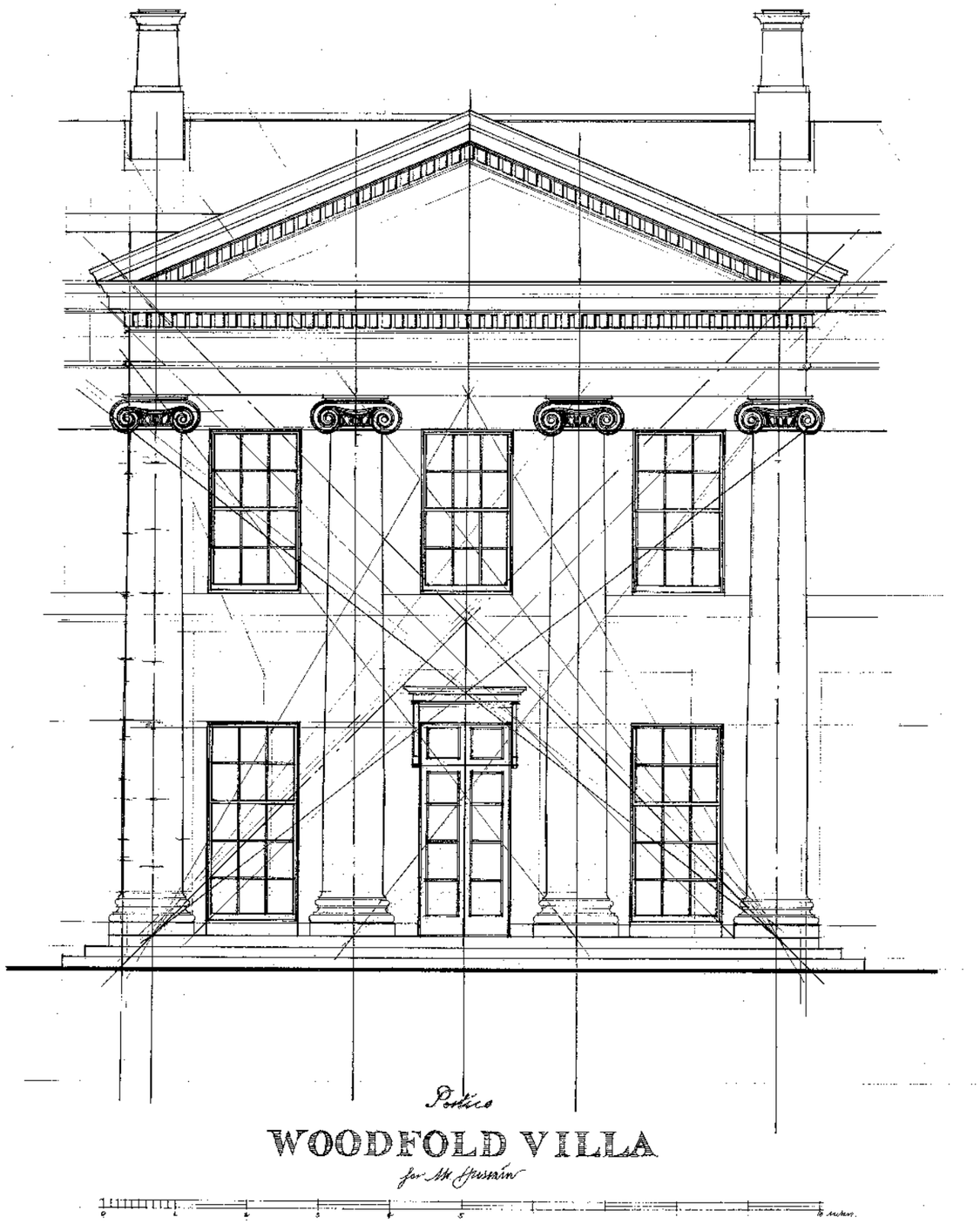
Setting out the parameters

Figure 19

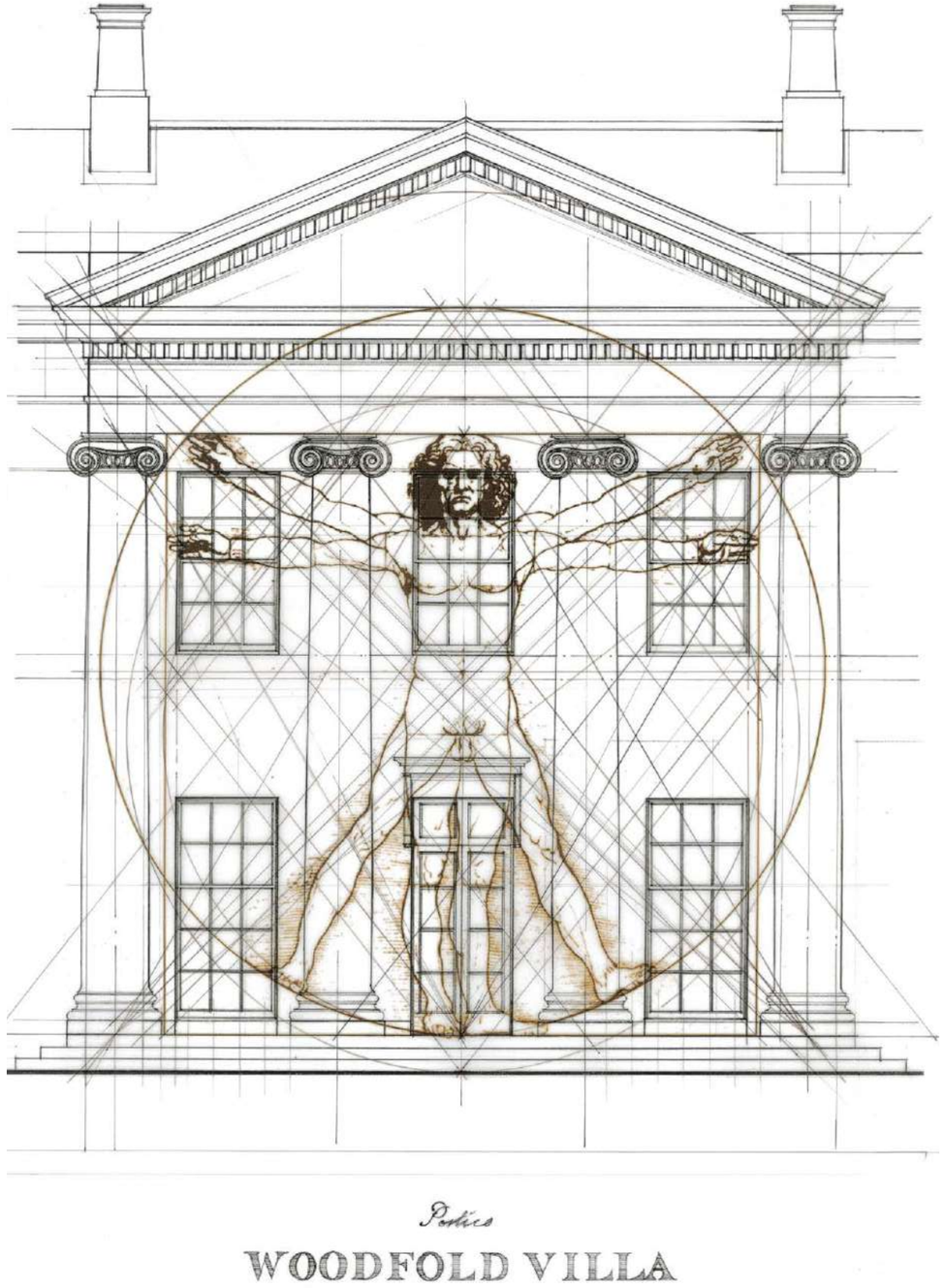


Setting out using the pyramid: 60°, Φ, 45° angles

Figure 20

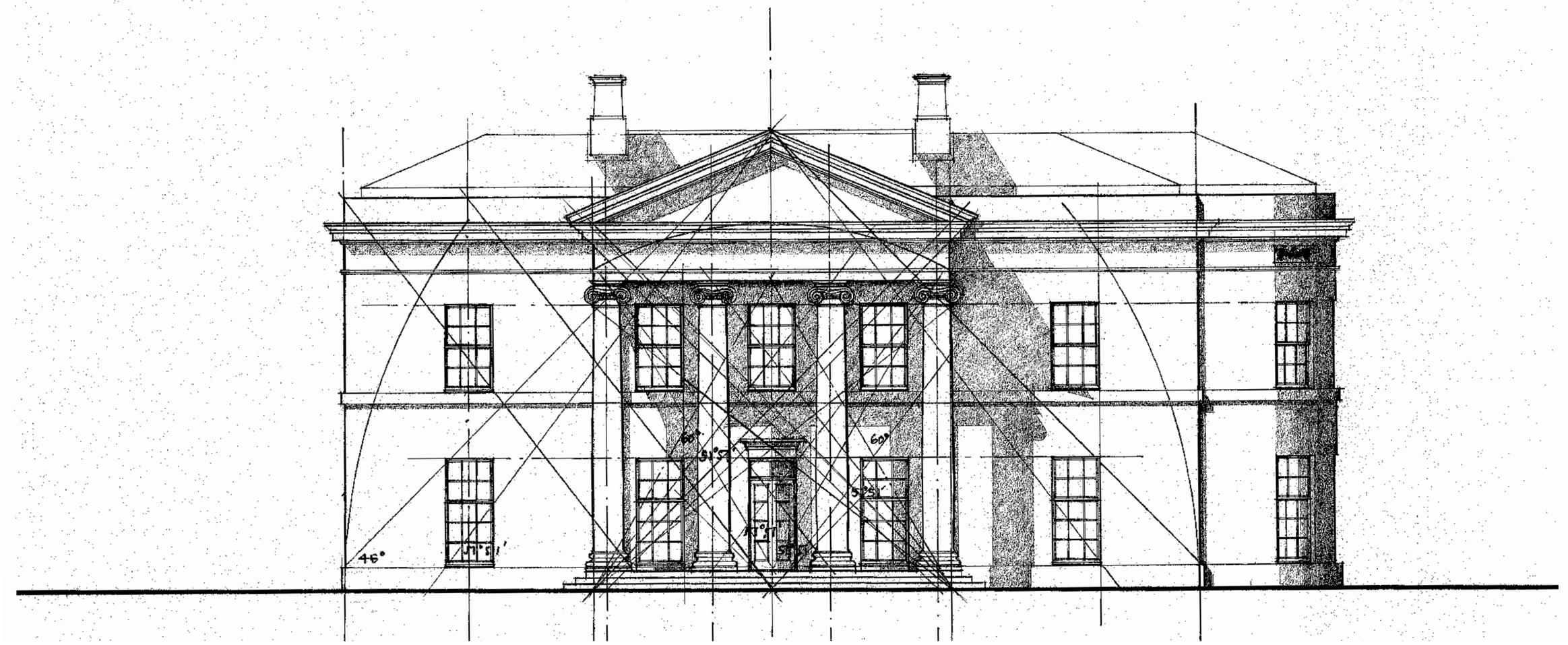


Germination diagram: Φ, the pyramid, 45°, 60°



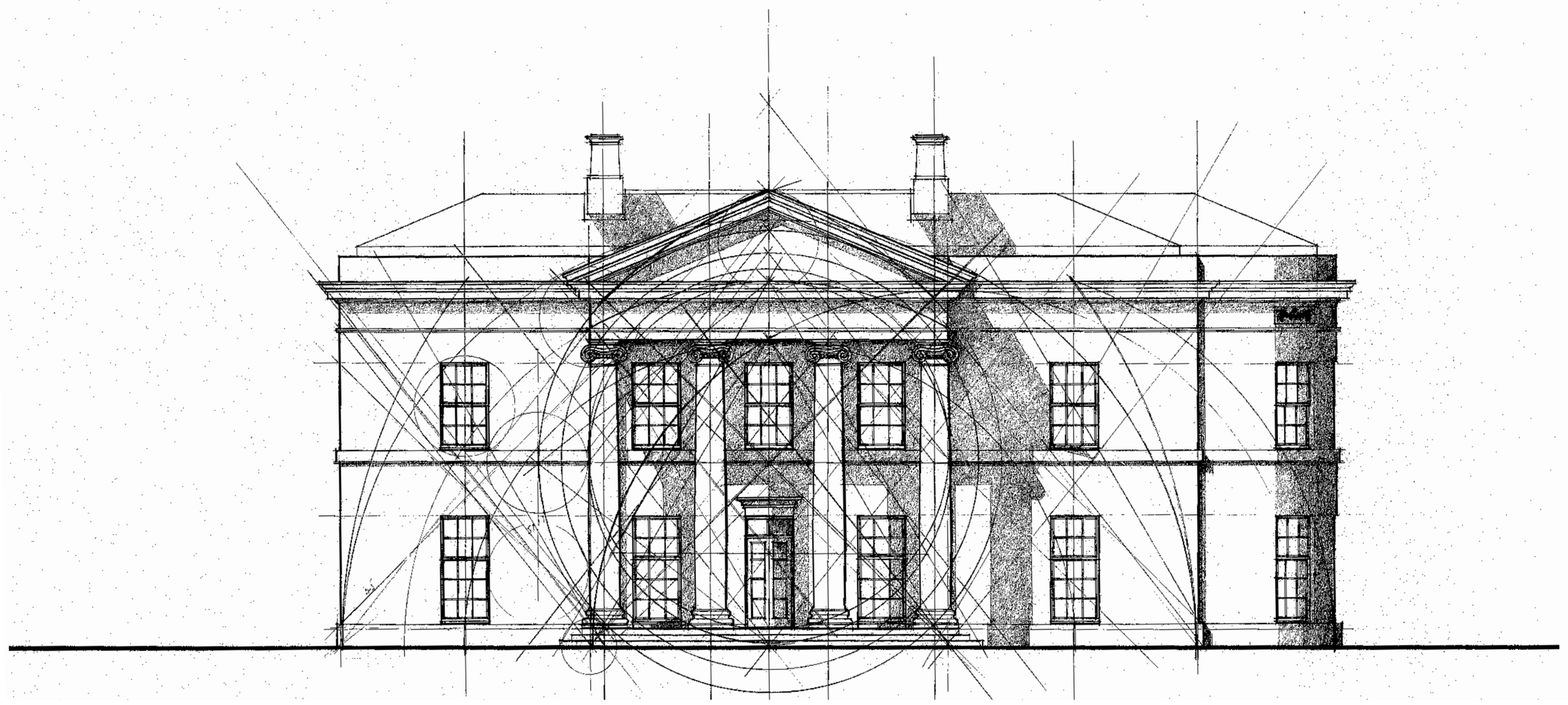
Germination of Vitruvian geometry

Figure 21



Germination diagram using the pyramid: 60°, Φ, 45° angles

Figure 22

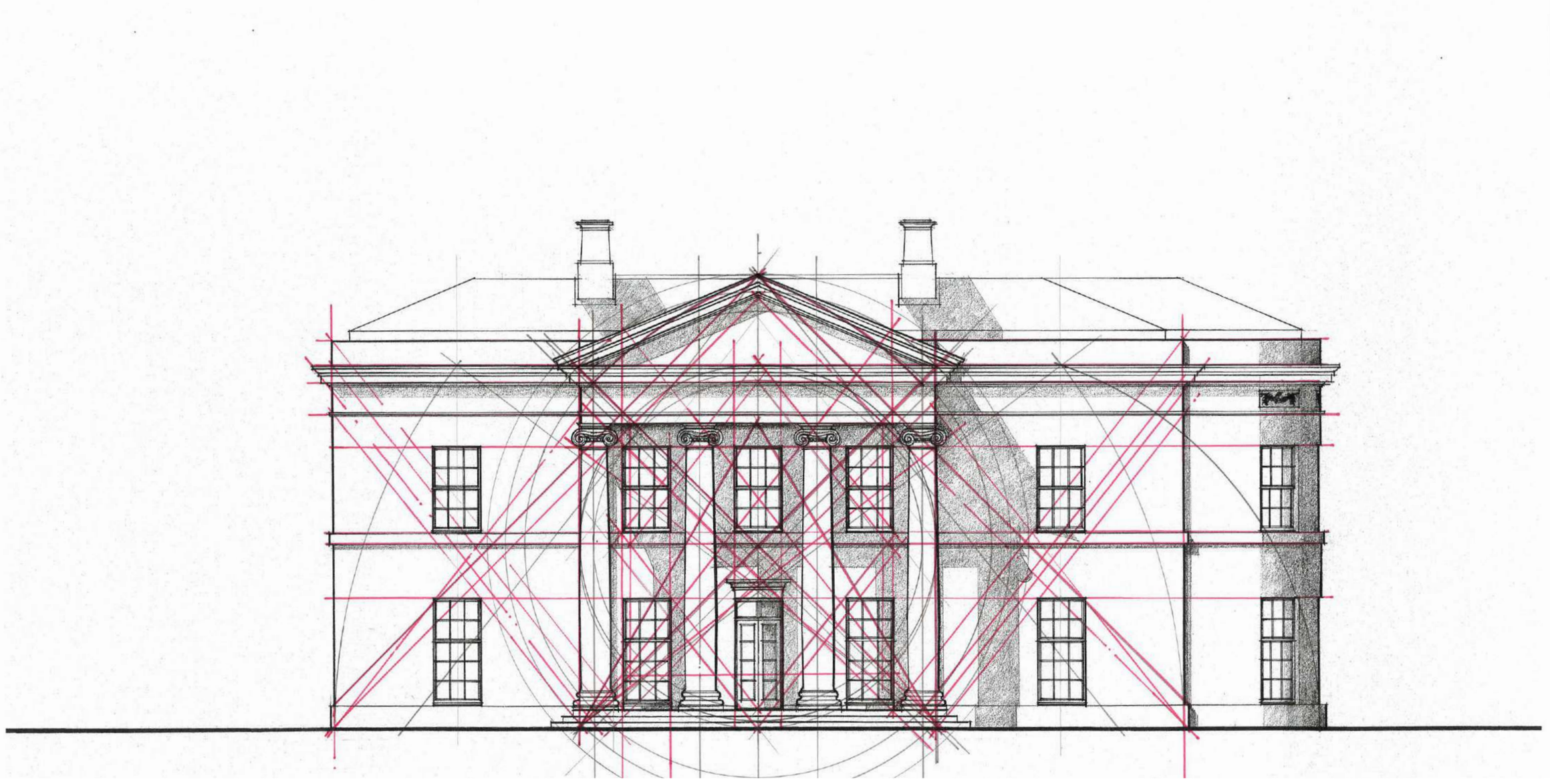


Vitruvuan geometry: Germination diagram

Figure 23

Germination geometry from Sand Reckoners diagram

Figure 24



North Elevation

WOODFOLD VILLA

for Mr. Hussain

0 1 2 3 4 5 10 metres.

Germination geometry of key proportions

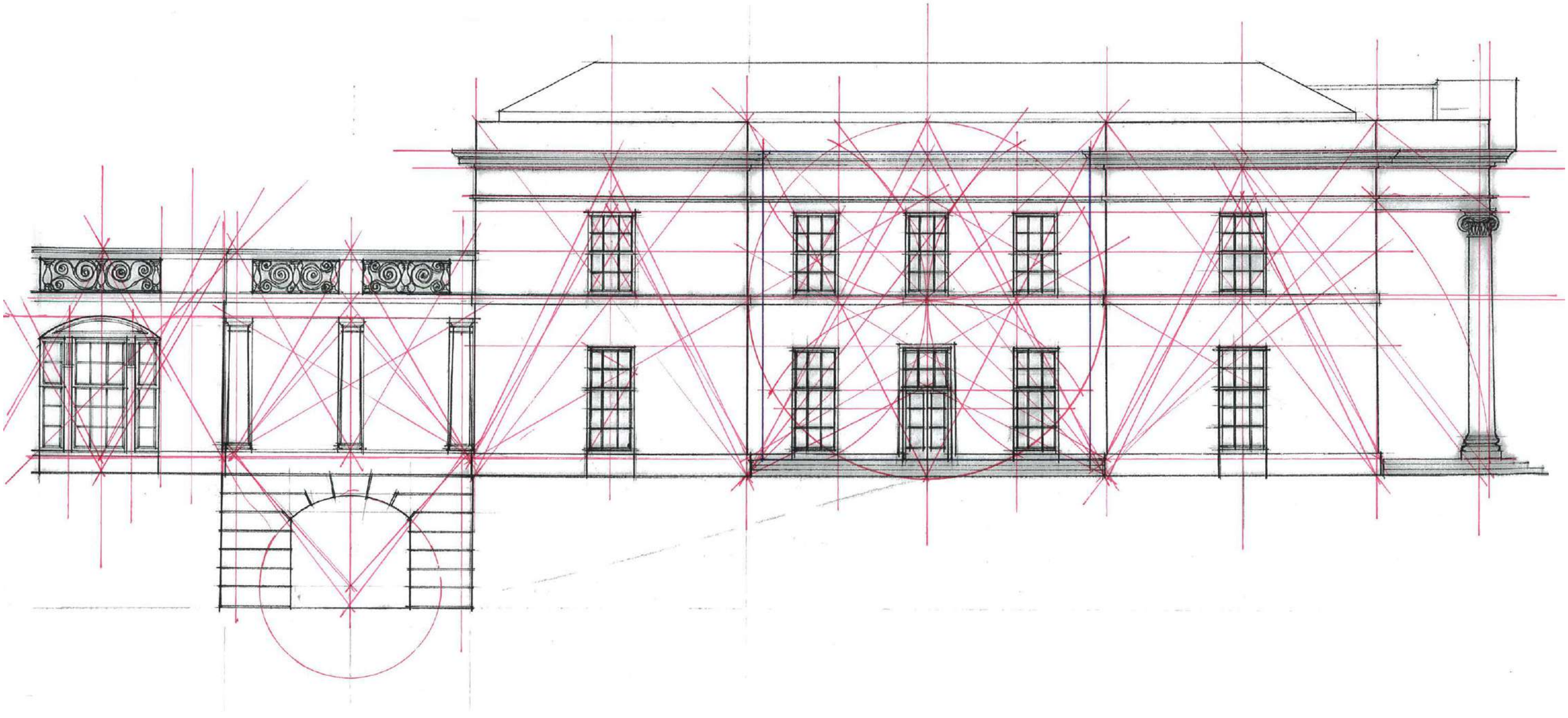
Figure 25

Germination of the pyramid 51° 51’

Figure 26

Germination of the 60° triangle

Figure 26



Squaring the circle, germination of Φ, the pyramid, 60° & 45° angles

Figure 27

Germination of 45°, pyramid (51°51'), 60° & Φ

Figure 28

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