

**COMENIUS PROJECT "STORYTELLER" - THIRD MEETING
BARI – ITALY - 9th APRIL 2014**

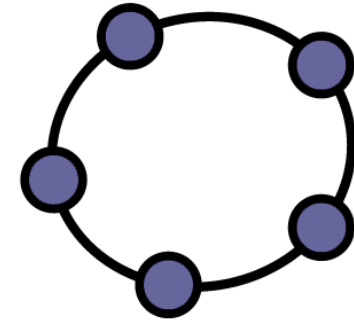


**WORKSHOP TASK: the Golden Rectangle and PHI number
Reconstruction of geometrical patterns using Geogebra.org**

**IISS Vivante-Pitagora – Bari
Prof. Palmira Ronchi and IV A_{SIA} students**



GeoGebra



Geometry +Algebra

Dynamic geometry, algebra and calculus

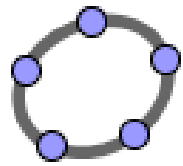
Open source (free of charge)

It runs on Windows, Linux, Solaris, MacOS

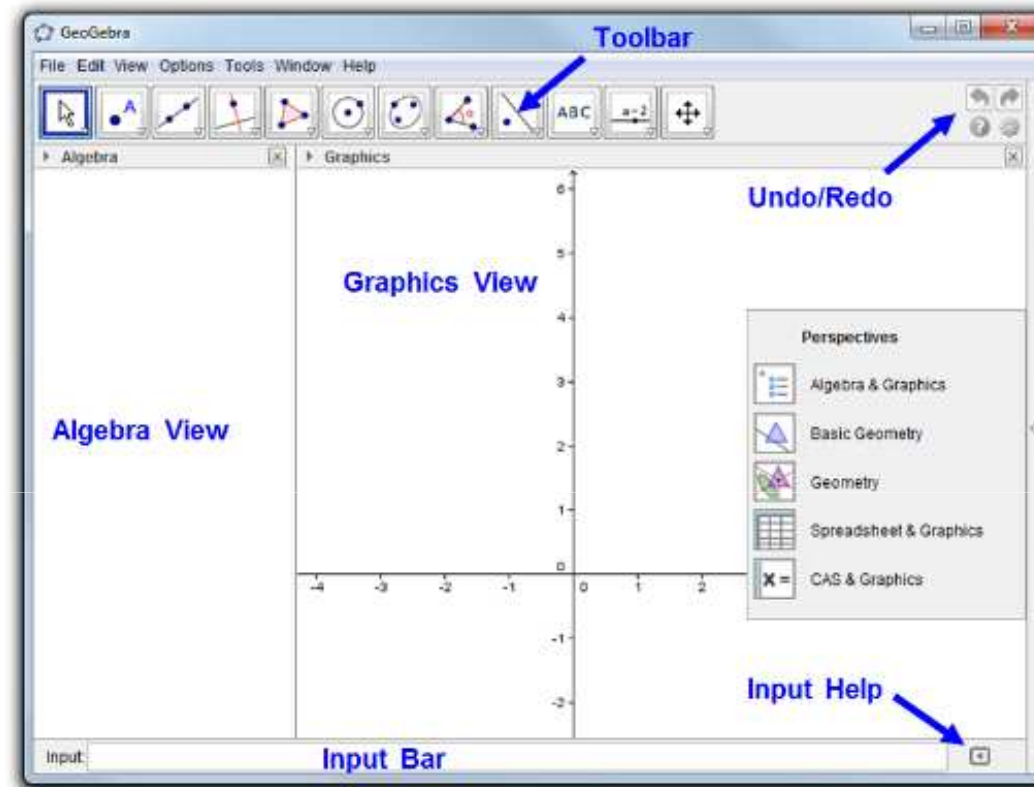
GeoGebra Tablet Apps



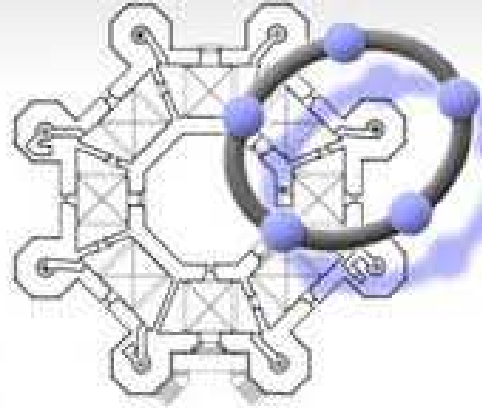
www.geogebra.org



GeoGebra's user interface



Using the provided geometry tools in the *Toolbar* you can create geometric constructions on the *Graphics View* with your mouse. At the same time the corresponding coordinates and equations are displayed in the *Algebra View*. On the other hand, you can directly enter algebraic input, commands, and functions into the *Input Bar* by using the keyboard. While the graphical representation of all objects is displayed in the *Graphics View*, their algebraic numeric representation is shown in the *Algebra View*. In GeoGebra, geometry and algebra work side by side.



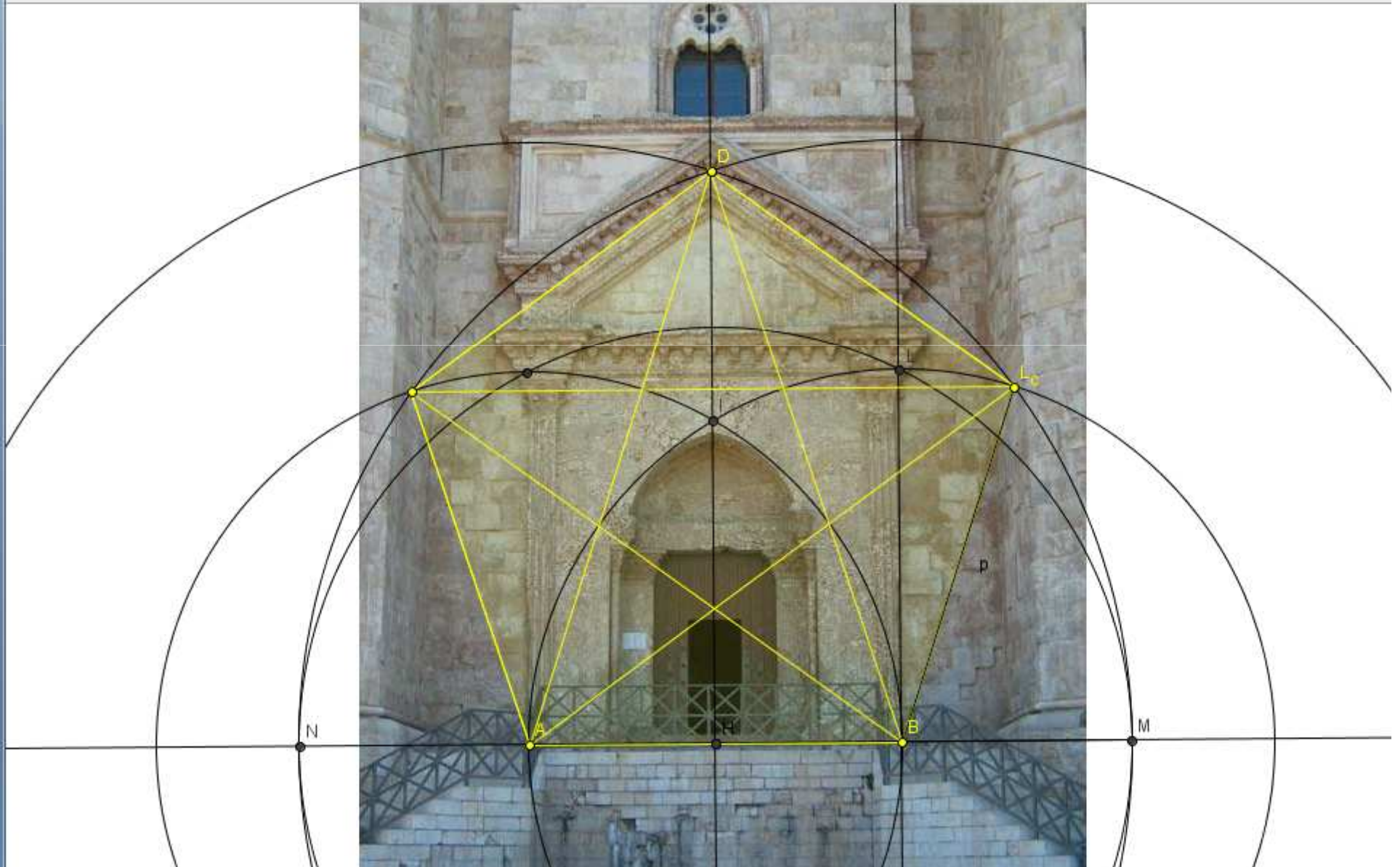
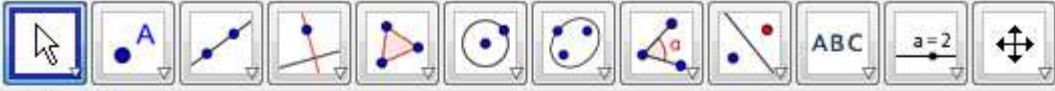
GeoGebra
Institute of
Bari

The castle was built about 1240 by Frederick II of Swabian and is well known for its octagonal shape.

A CASTLE FULL OF THE GOLDEN NUMBER AND MATHEMATICAL SYMBOLS .



Castel del Monte – Andria di Bari (Italy)
Castle of the Mount



THE BUILDING OF CASTEL DEL MONTE

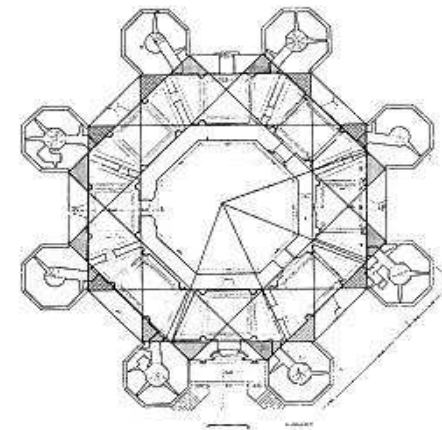
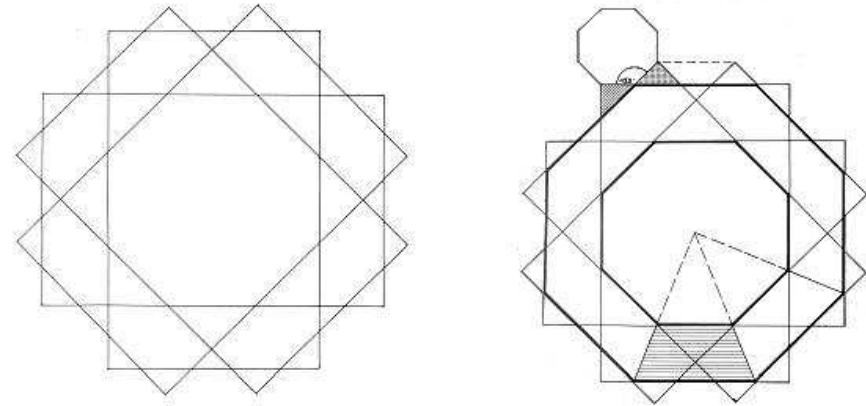
Four golden rectangles draws two octagons: an external one and an internal one.

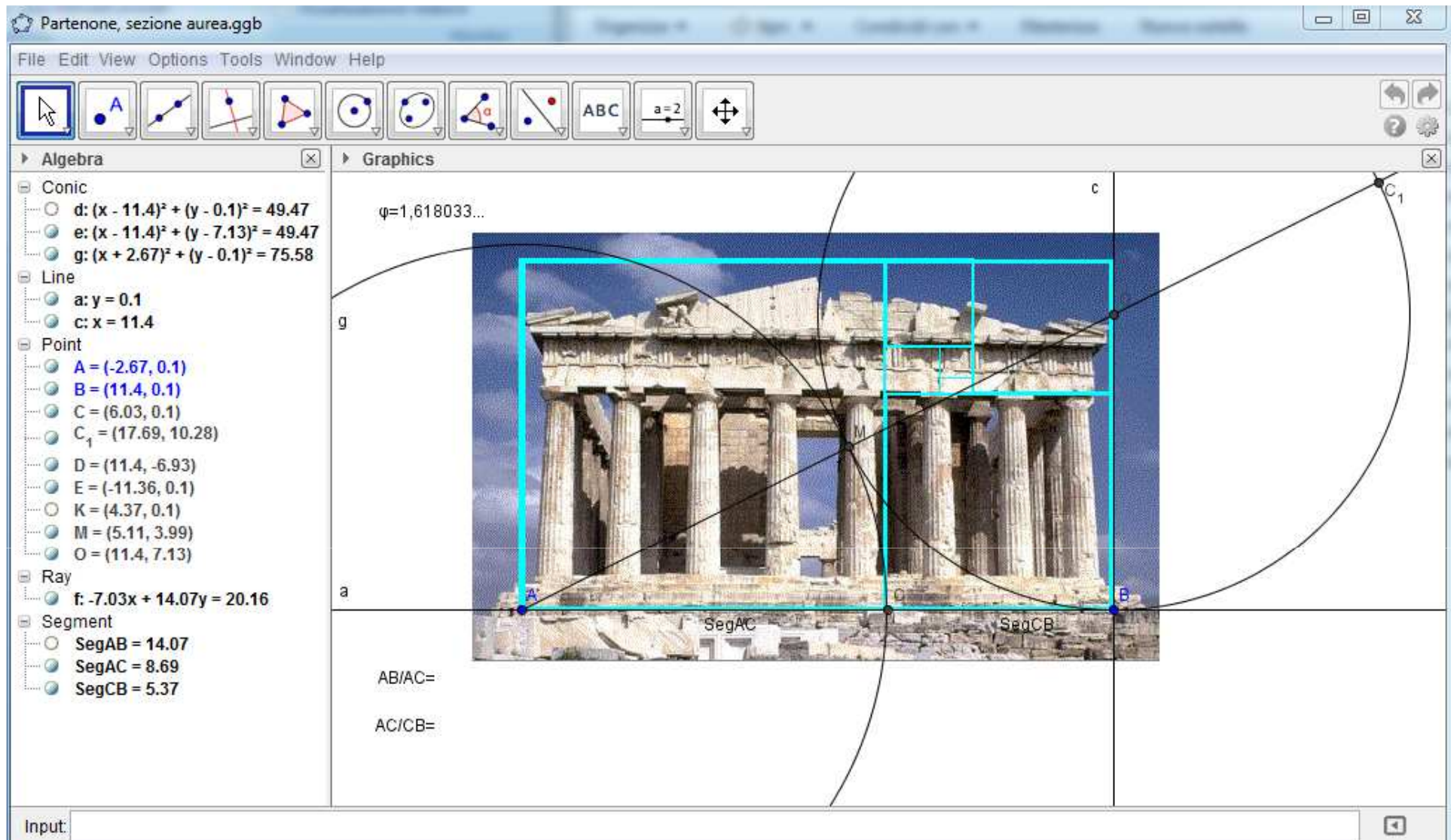
The octagon coincides the internal and external walls.

Rectangle sides: 35.60 m and 22 m.

$$(35,60)/22 = \Phi = 1,618\dots$$

Φ = the Greek letter phi,
the golden number

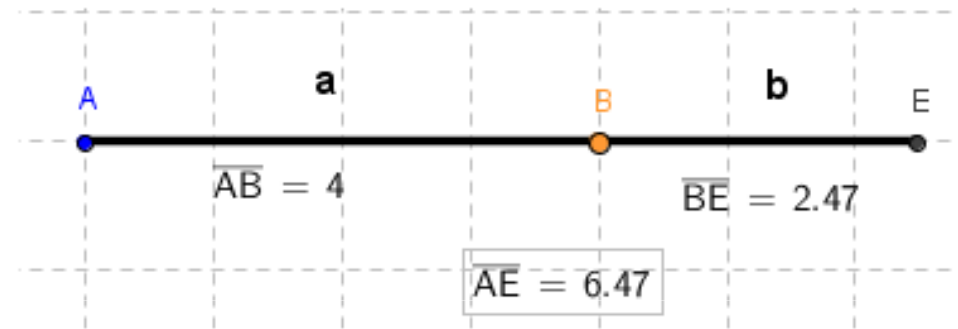




The [Greek](#) letter ([phi](#)) mean of **Phidias** ([Φειδίας](#), *Pheidias*; c. 480 – 430 BC) was a [Greek](#) sculptor, painter and architect of [Parthenon](#), who lived in the 5th century BC in Athen, and is commonly regarded as one of the greatest of all sculptors of [Classical Greece](#).

For more details on the Golden ratio surf on this [youtubevideo2](#)

The golden ratio has fascinated intellectuals of diverse interests for at least 2,400 years. Some of the greatest mathematical minds of all ages, from [Pythagoras](#) and [Euclid](#) in [ancient Greece](#), through the medieval Italian mathematician [Leonardo of Pisa \(Fibonacci\)](#) and the Renaissance astronomer [Johannes Kepler](#), have spent endless hours over this simple ratio and its properties.



In [mathematics](#) and the [arts](#), two quantities (segments a and b) are in the **golden ratio** if the [ratio](#) between the sum of those quantities and the larger one is the same as the ratio between the larger one and the smaller.

$$\frac{a+b}{a} = \frac{a}{b} = 1,6180339887... = \Phi$$

The golden ratio can be expressed as a [mathematical constant](#), usually denoted by the [Greek](#) letter φ ([phi](#)). For more details on the Golden ratio surf on this [youtubevideo2](#)

TASK: the Golden Rectangle and PHI number [youtubevideo1](#)

TASK: the Golden Rectangle and PHI number: in this activity you are going to construct a Golden Rectangle, and to search it in art using Geogebra: a dynamic geometric free software, available in more than 50 languages (see menu "option/languages").

The image displays the Geogebra software interface on the left and a photograph of the Mona Lisa on the right. The Geogebra window shows a construction of a Golden Rectangle. A horizontal line segment AE is shown with point M at its midpoint. A vertical line segment AB is drawn at point A . A semicircle is drawn with center M and radius MA . A vertical line is drawn from point C on the semicircle down to point B on the line AE . A horizontal line CD is drawn from C to the semicircle at point D . The rectangle $ABCD$ is shaded in light brown. The Golden Ratio is displayed as $AE/AB = 1.618$ and $AB/BE = 1.618$, labeled as the "PHI number". The Geogebra interface includes a menu bar (File, Edit, View, Options, Tools, Help), a toolbar with various geometric tools, and a list of objects on the left. The list includes free objects $A = (-1.62, -0.8)$, $B = (2.2, -0.8)$, $G = (5.82, 4.92)$, and $H = (7.8, 4.92)$, and dependent objects $E = (5.5317, -0.8)$, $F = (5.5317, 3.62)$, $M = (0.59, -0.8)$, $a: y = -0.8$, $a_1 = 4.42$, $a_2 = 7.1517$, $b = 4.42$, $c = 4.42$, $d = 4.42$, $d_1 = 4.42$, $\text{distanceAB} = 4.42$, $\text{distanceAE} = 7.1517$, $\text{distanceBE} = 2.7317$, $e: (x - 0.59)^2 + (y + 0.8)^2$, $e_1 = 4.42$, $f: x = 5.5317$, $f_1 = 7.1517$, $g: y = 3.62$, $g_1 = 1.98$, $h = 4.9417$, $h_1 = 1.98$, and $i = 1.98$. The bottom of the window shows a status bar with "25 / 25" and a "Play" button.

The Mona Lisa on the right has a yellow Golden Rectangle overlaid on her face, illustrating the Golden Ratio in art.

How many golden rectangles do you can find in Monna lisa?

