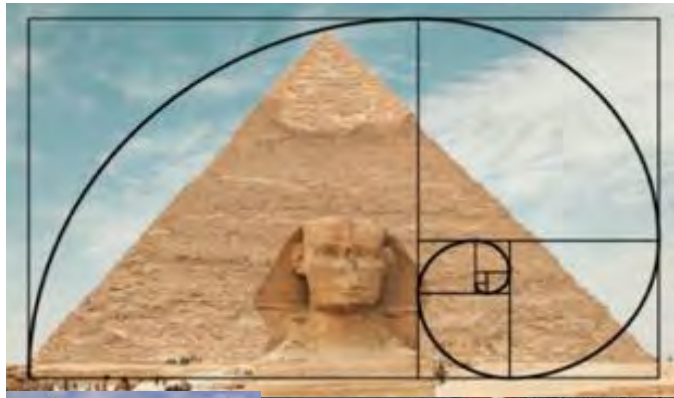
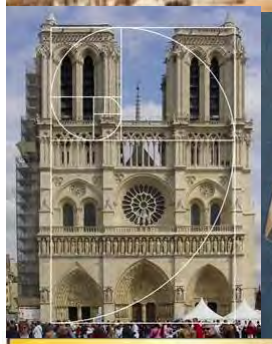
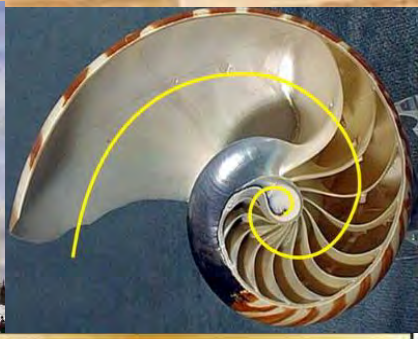
Funded by the
Erasmus+ Programme
of the European Union

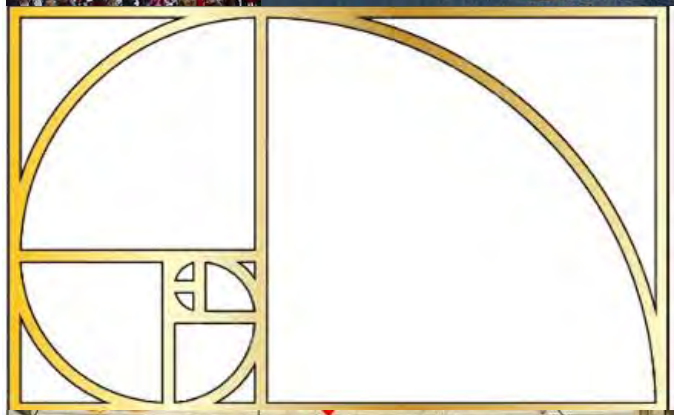
SCIENCE IS ALL AROUND US
ERASMUS +

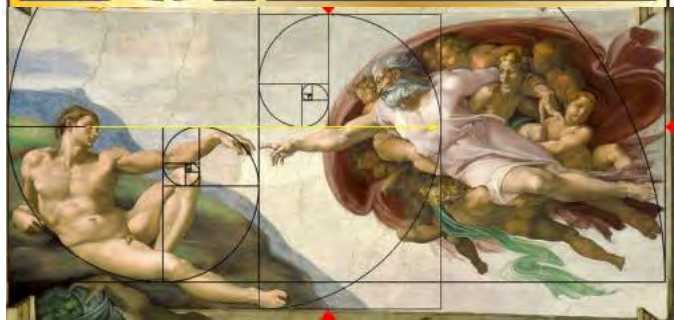
The Golden Ratio









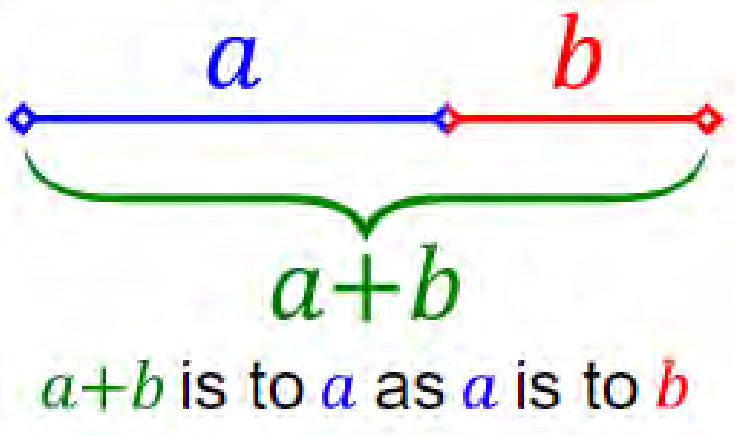


Osnovna škola Višnjevac

What is beauty?

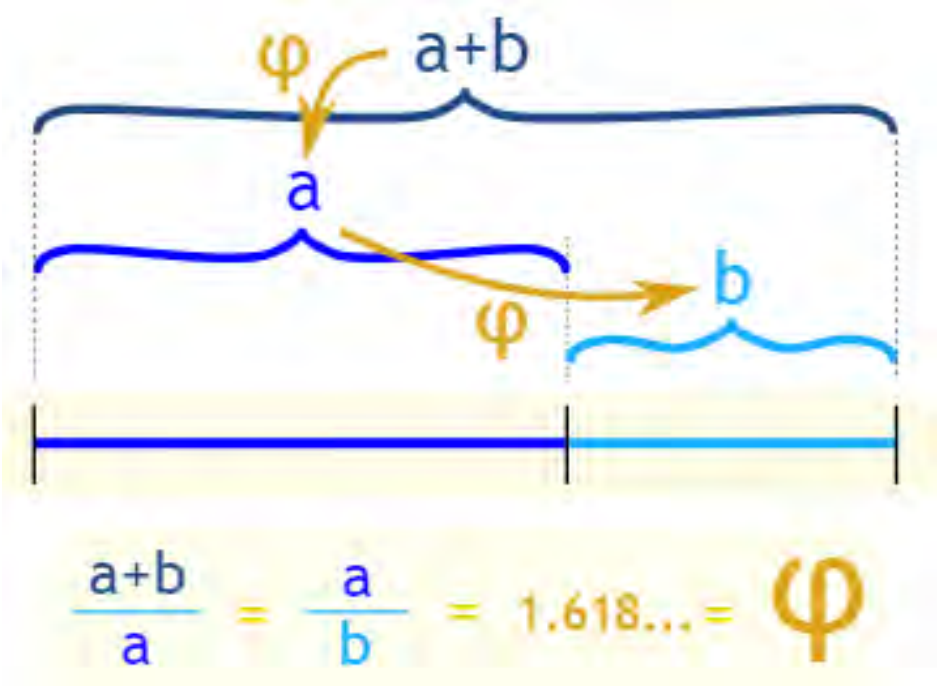
- Does it lie in the eye of the beholder or in the perfection of ratio?
- When we speak about beauty, there are two concepts that are inseperable: ***The Golden Ratio*** and ***Fibonacci Sequence***.

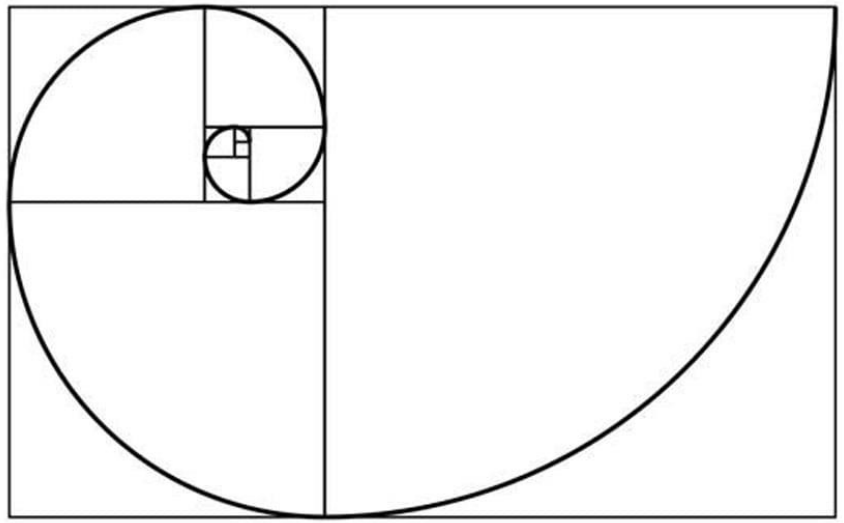
- The golden ratio or divine proportion is the ratio of a line segment such that the ratio of the whole segment to that of the longer segment is equal to the ratio of the longer segment to the shorter segment. $\frac{a+b}{a} = \frac{a}{b}$



- In maths we express this number by φ and it equals

$$\varphi = \frac{\sqrt{5}+1}{2} = 1.618\,033\,988\,749\,894\,848\ldots$$





The Fibonacci sequence

Leonardo Fibonacci (1170 -1250), was one of the most prominent medieval mathematicians.

His greatest contribution was that he introduced the Arabic numbering system.

In his work *Liber Abaci* (1202) Fibonacci gave an interesting example of calculation using the rabbit problem of reproduction where he came to the following sequence:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, …

- 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, …

By taking the ratio of successive Fibonacci numbers, we will get a sequence of numbers which oscillate around the numer φ. If the value of these numbers is bigger, we get closer to the number φ.

$$\frac{1}{1} = 1 \qquad \frac{2}{1} = 2 \qquad \frac{3}{2} = 1.5 \qquad \frac{5}{3} = 1.6666667 \qquad \frac{8}{5} = 1.6 \qquad \frac{13}{8} = 1.625$$

$$\frac{21}{13} = 1.6153846 \qquad \frac{34}{21} = 1.6190476 \qquad \frac{55}{34} = 1.617647$$

….

$$\frac{10946}{6765} = 1.618033999 \qquad \frac{17711}{10946} = 1.618033985 \qquad \frac{28657}{17711} = 1.61803399$$

Nature loves golden ratio

The number of petals on many flowers is a Fibonacci number. Besides the petals, we can find number φ in the growth of the plant, too.

White calla lily is one of the rarest flowers which have only ***one petal.***

Euphorbia millii have ***two petals.***

Trillium flower have ***three petals.***

Columbine flower have ***five petals***.

Bloodroot have ***five*** or ***eight petals***.

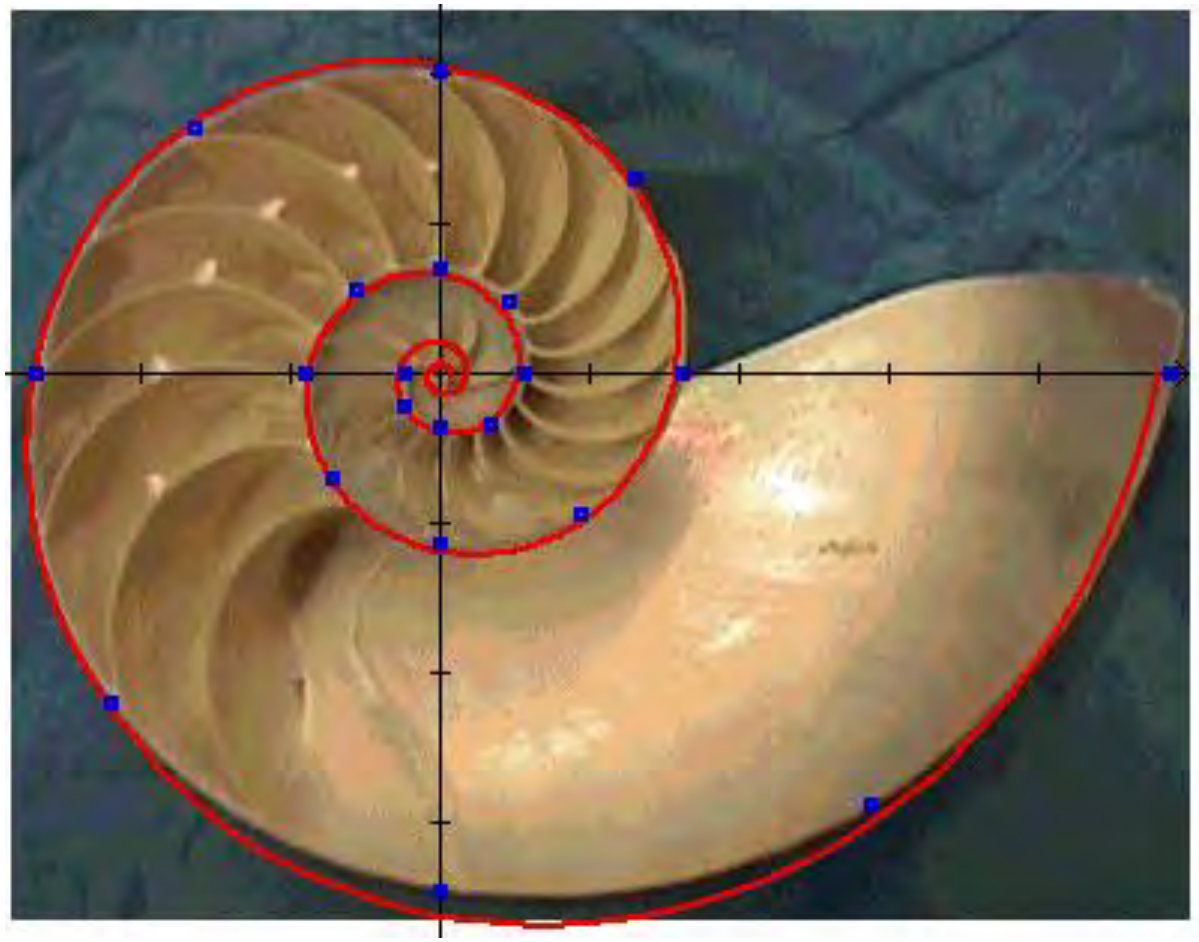
Black-eyed susan is a flower having ***thirteen***(13) petals

Shasta daisy is the flower having ***twenty-one*** petals. This type of flowers have 21 or 34 petals.

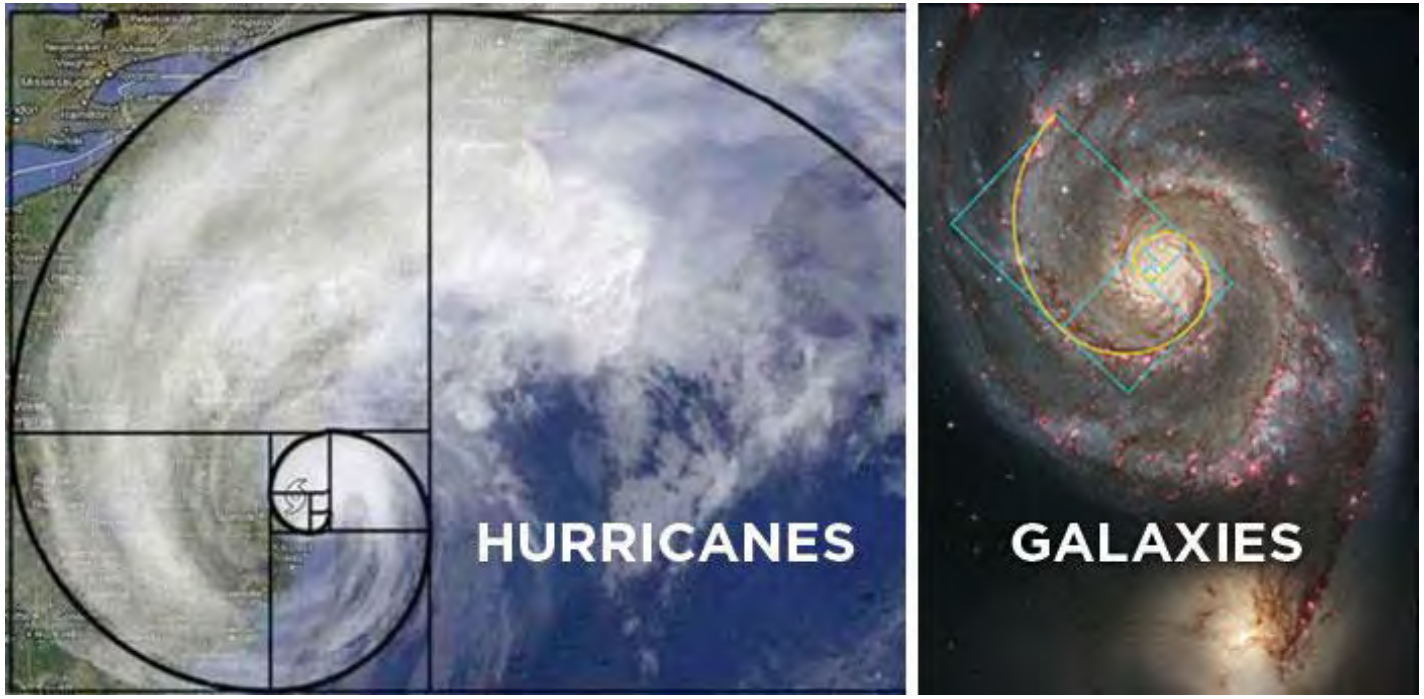
- In sunflowers, there are two series of curves that wind in opposite directions, with seeds positioned at a certain angle from each other to create a beautiful spiral.
- These spirals pack sunflower florets as tightly as possible to maximize their ability to capture sunlight for the plant.

- If you take a look at the structure of a pine cone, you can see 8 spiral rows of the seed counterclockwise and 13 spiral rows clockwise.

- Nautilus shell in its cross section perfectly shows the form of the golden spiral.



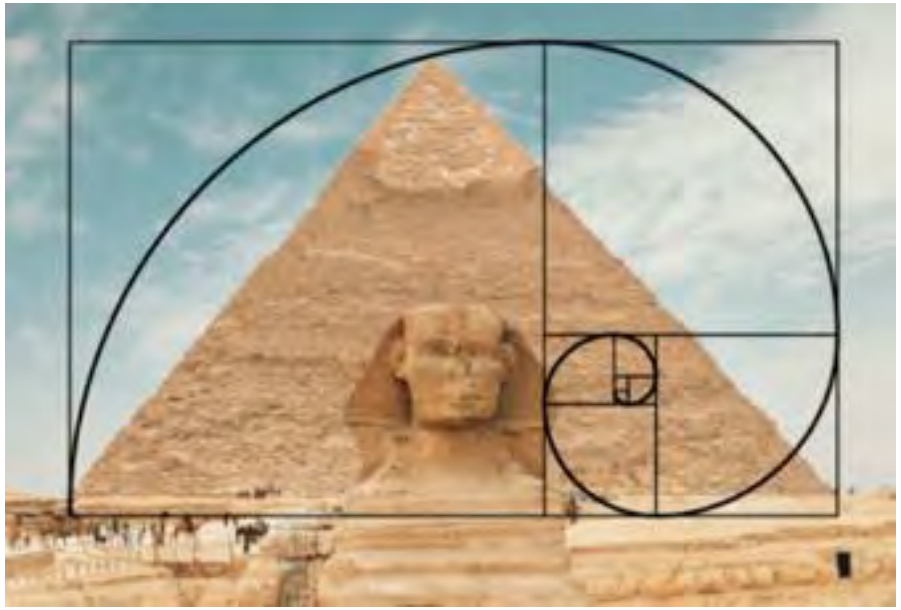
- Large storms, hurricanes and tornadoes also show the rules of the golden ratio. Galaxies also have the form of the golden spiral, which we can best observe in our Milky Way Galaxy.

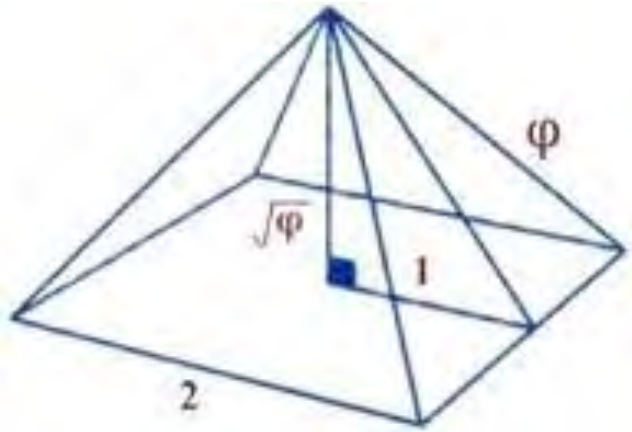


Golden Ratio in architecture and art

The Great Pyramid of Giza (2570 BC) is one of the most ancient and the best examples of the use of the Phi.

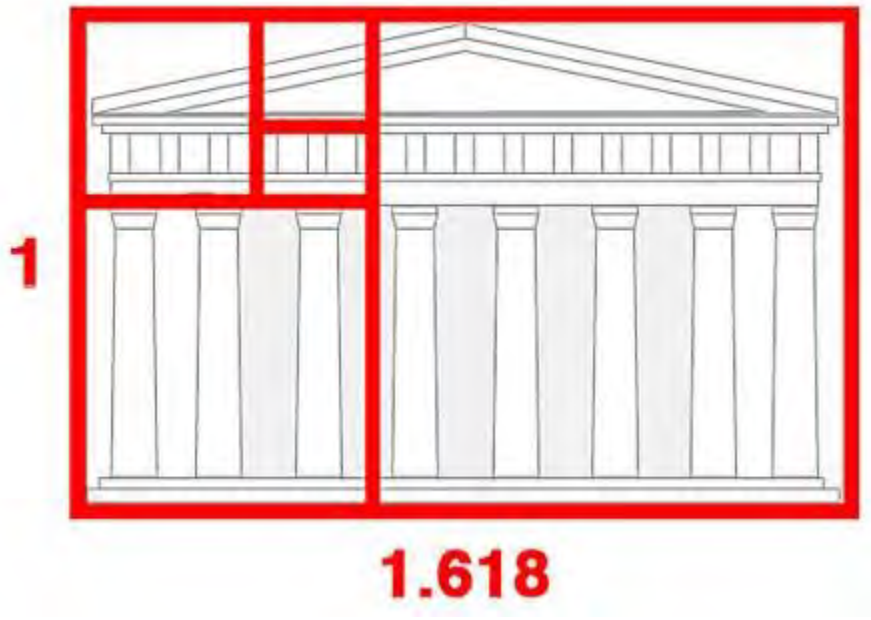
The ratio of the height of the pyramid to either of the sides of its base approximately equals to Phi.



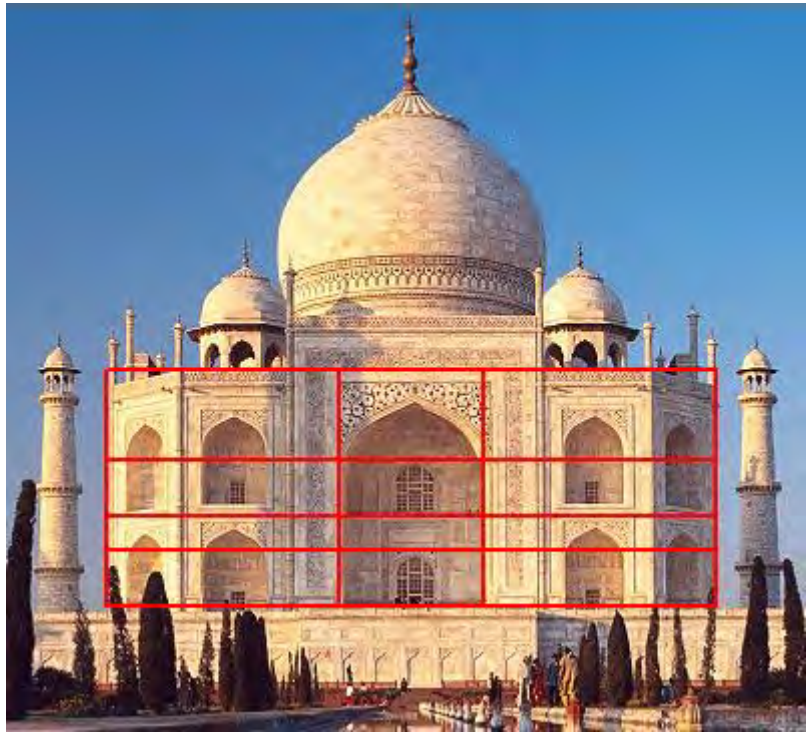


Almost all the buildings of Ancient Greece used this proportion to define the proportion of the height of the buildings to their base.

The Parthenon is one of the most famous examples of ancient Greek buildings designed using the Golden Ratio.



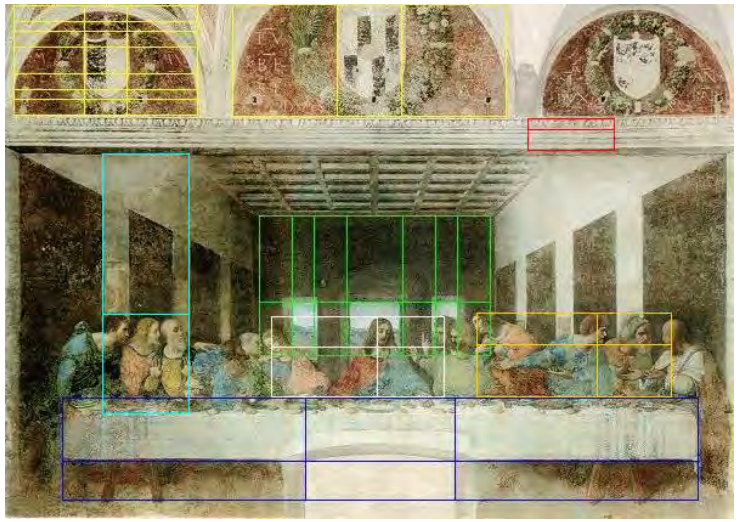
Notre Dame in Paris, which was built in between 1163 and 1250 appears to have golden ratio proportions in a number of its key proportions of design.



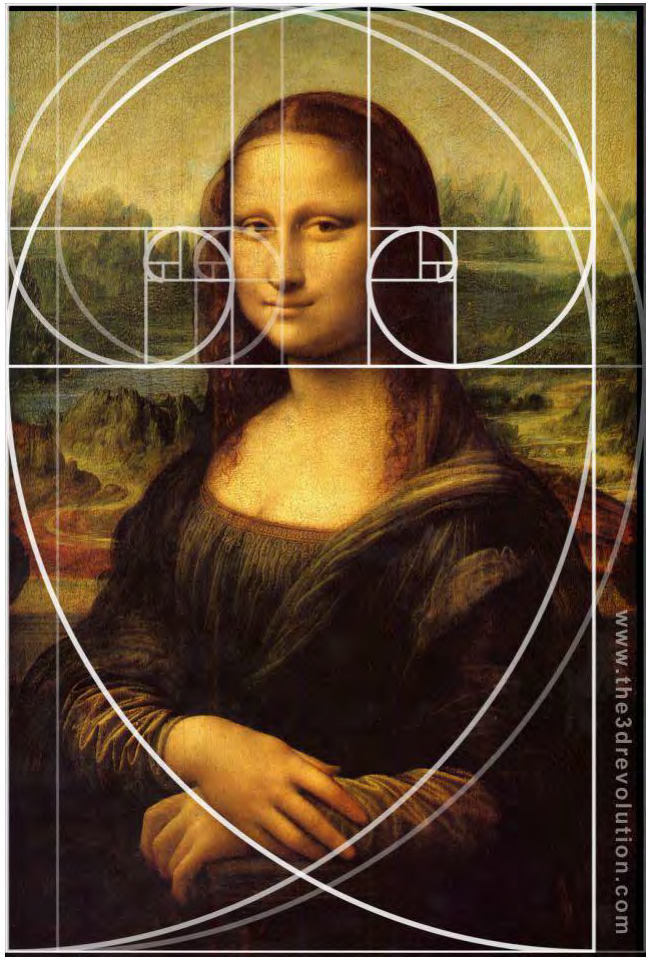
The Taj Mahal

St. Paul Cathedral

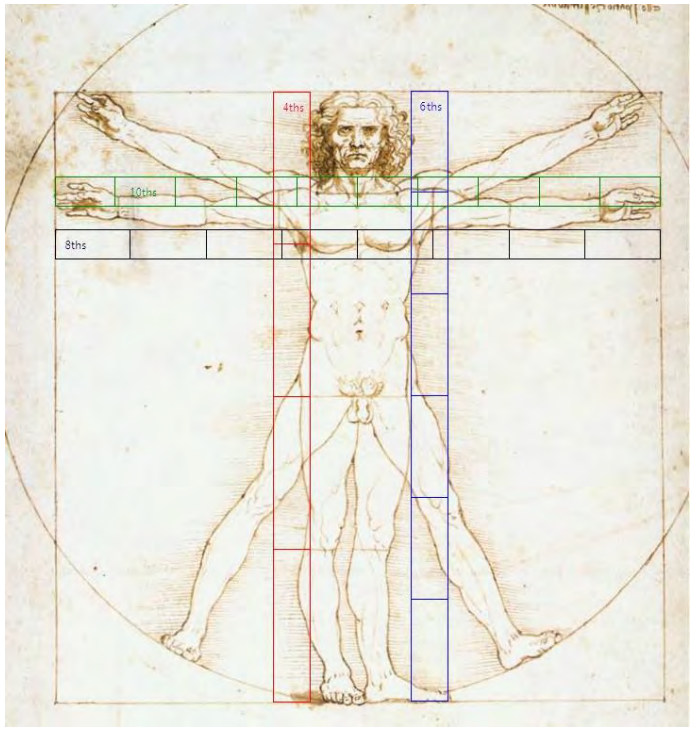
Leonardo Di Vinci found importance in golden ratio, as seen evident in his paintings.



The Last Supper

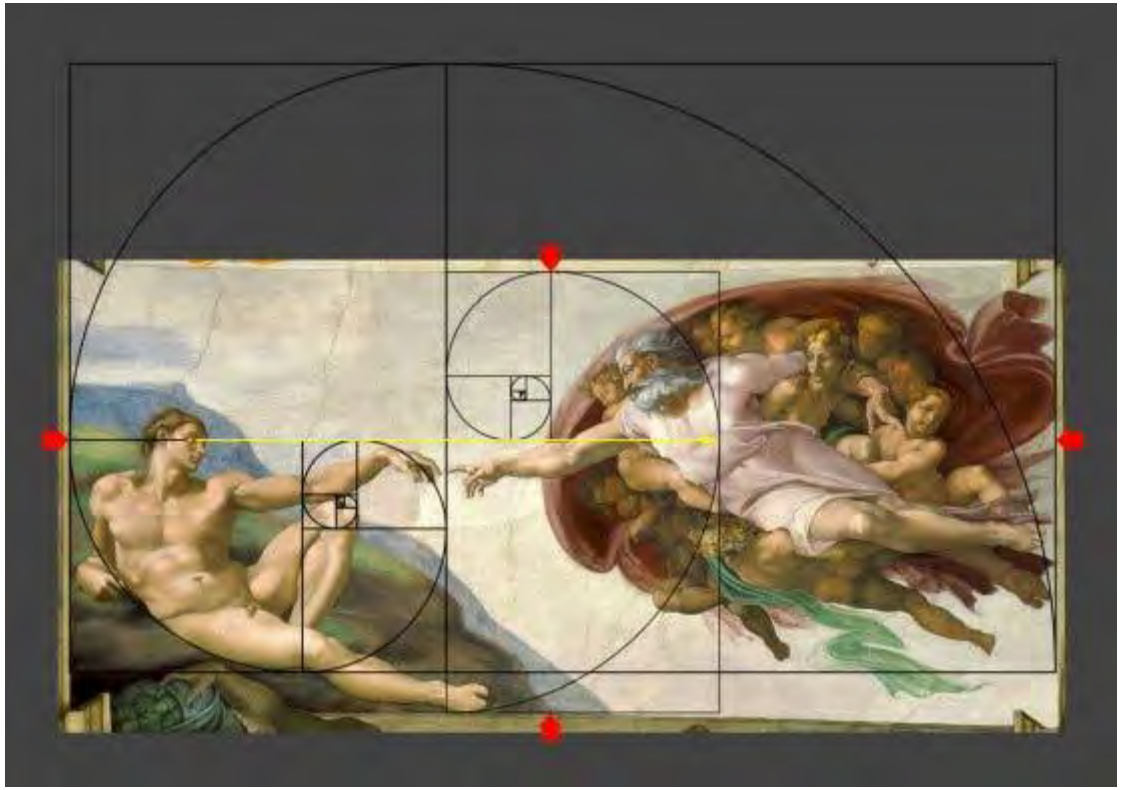


Mona Lisa

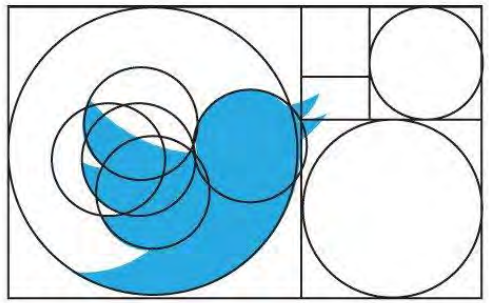


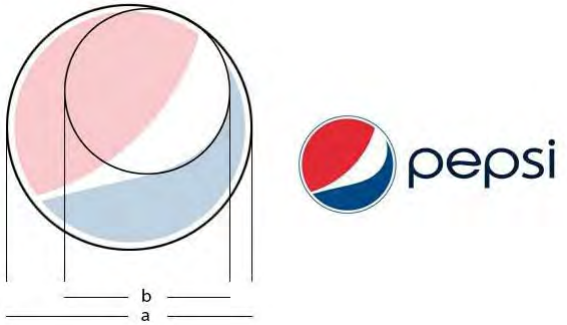
Vitruvian Man

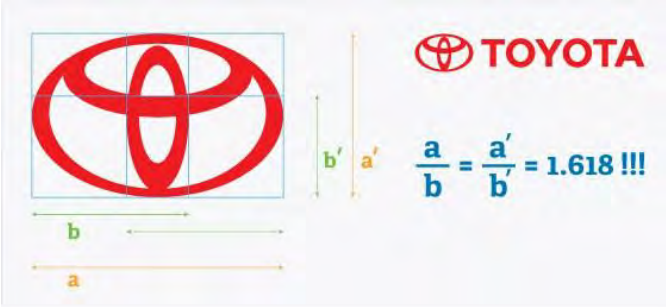
- We can also see golden ratio clearly in Michelangelo's interpretation of Adam and God on the Sistine Chapel.
- When we examine the alignment of God and Adam we can press them into a rectangle which correlates perfectly with the golden ratio.
- We can also observe that the meeting point between the two is at the exact golden ratio point.

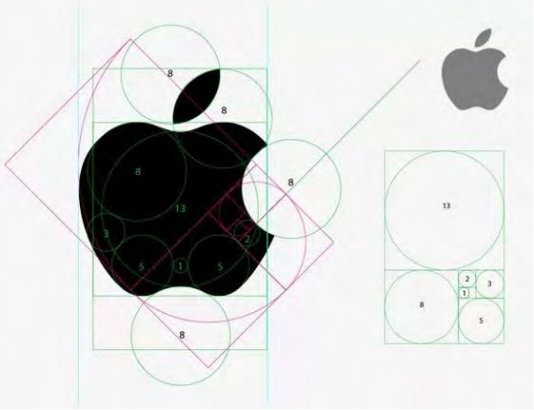


If you're designing a new logo and feeling stuck, turn to the Golden Ratio to help you sketch out the proportions and shapes. Many popular logos follow the Golden Ratio, like Twitter, Apple, and Pepsi.









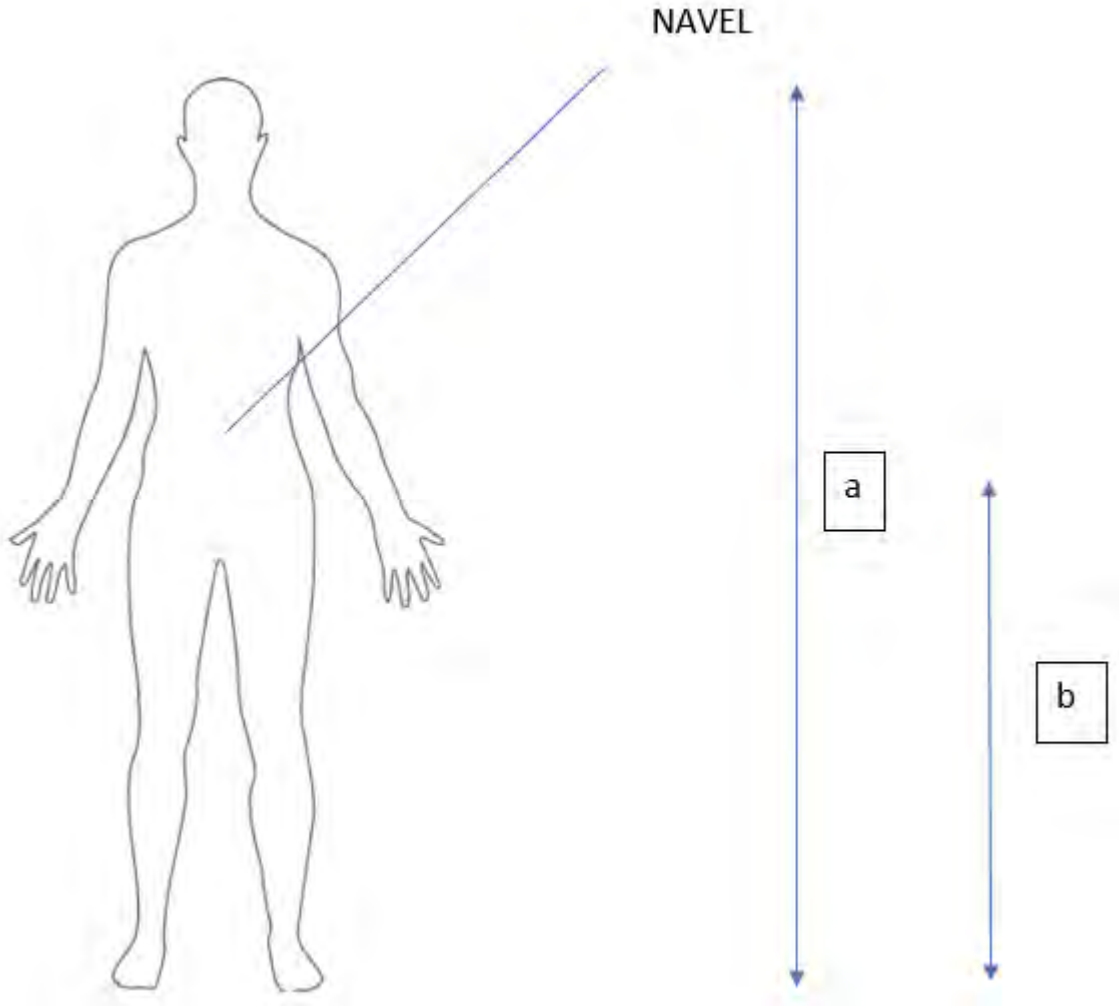
Dimensions of credit cards, ID cards and many other cards are 86 mm * 54 mm. The ratio of their sides equals 1.6.

There are many examples of the Divine Proportion found throughout the design of the universe and everything in it, but let's take a look at one of the most important things: You!

Task:

1. Measure your height (a)
   a=_____cm
2. Measure the length from the
   foot to the navel (b)
   b=_____cm
1. Divide a by b

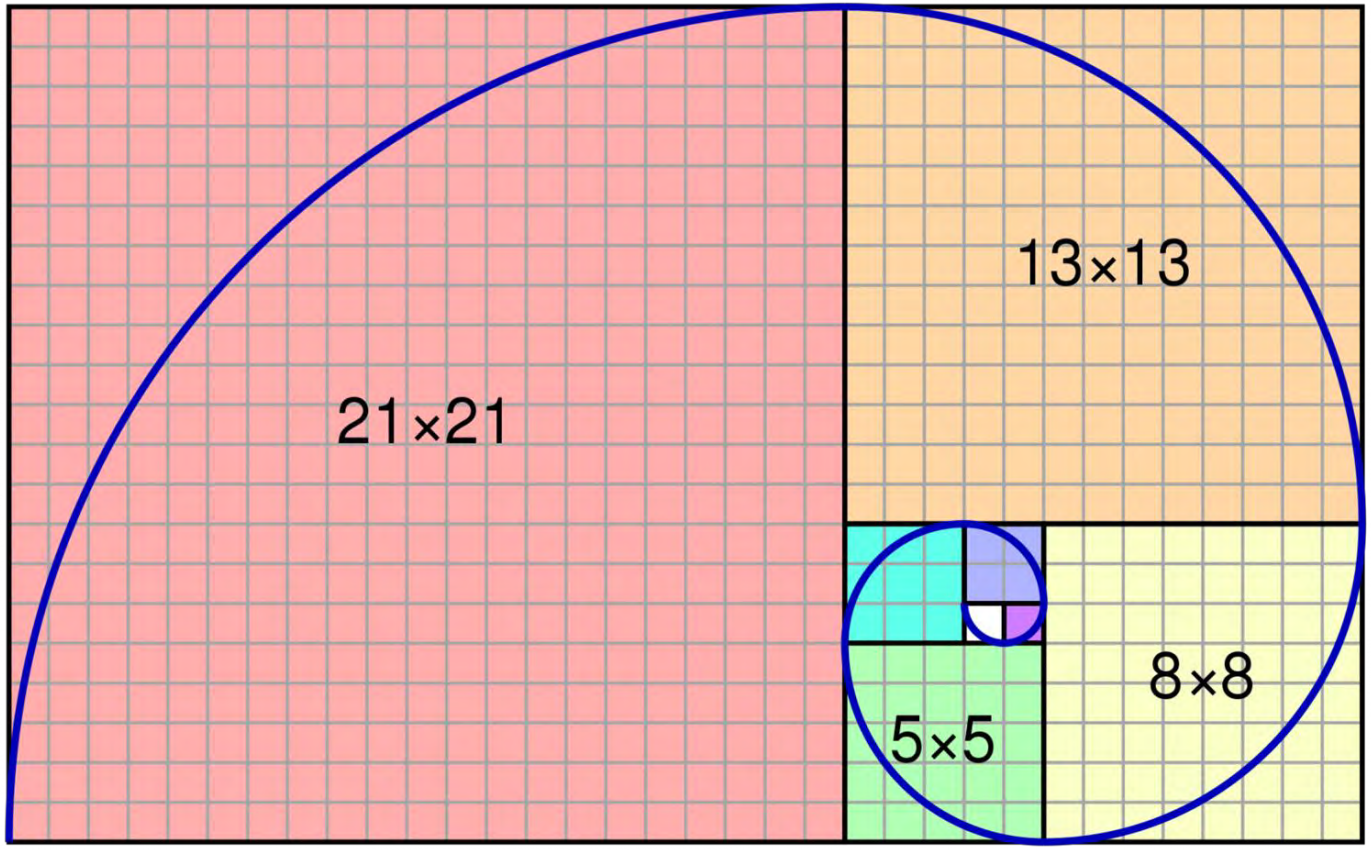
   a: b =_____



How can we construct the golden ratio?

The things become very interesting if we try to show them by means of geometry.

Because when you draw squares using dimensions of Fibonacci sequence, you will create the famous golden spiral.




GoldieBlox®
goldieblox.com