Mathematics and visual arts

Golden ratio (section)

Magic square - a square array of numbers, if the sums of the numbers in each row, each column, and both main diagonals are the same.

Rhombohedron - is a three-dimensional figure with six faces which are rhombi.

Truncated

Three-dimensional

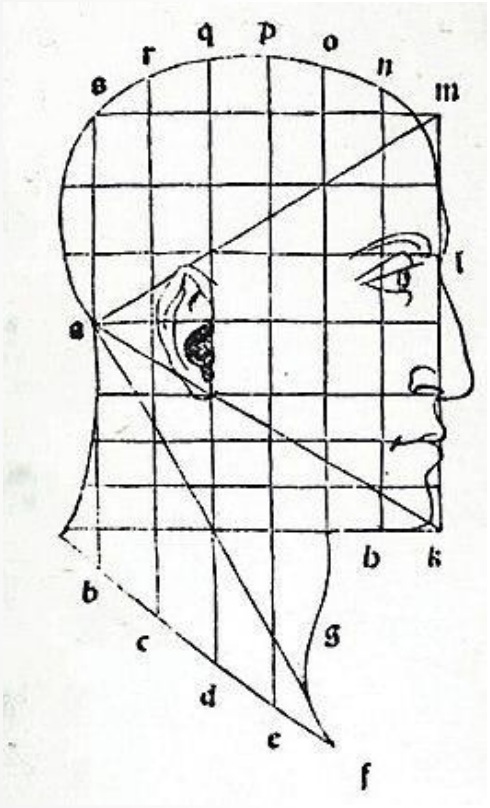
Perspective - the formation of an image in a picture plane of a scene viewed from a fixed point, and its modeling in geometry.

Autofocus

Post-processing

Painters began to use the mathematical concepts from the IV century BC, but it received great development in the Middle Ages. An example of such a work is Melancholy painted by A. Durer. This engraving depicts a compass, a magic square and a truncated rhombohedron.

Renaissance Era

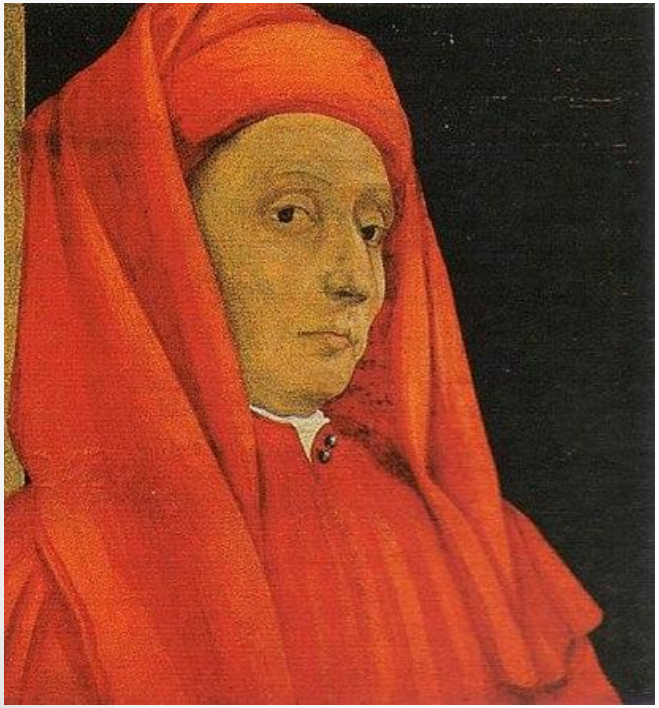


Engraving from Luca Pacioli's treatise "The Divine Proportion" (1509)

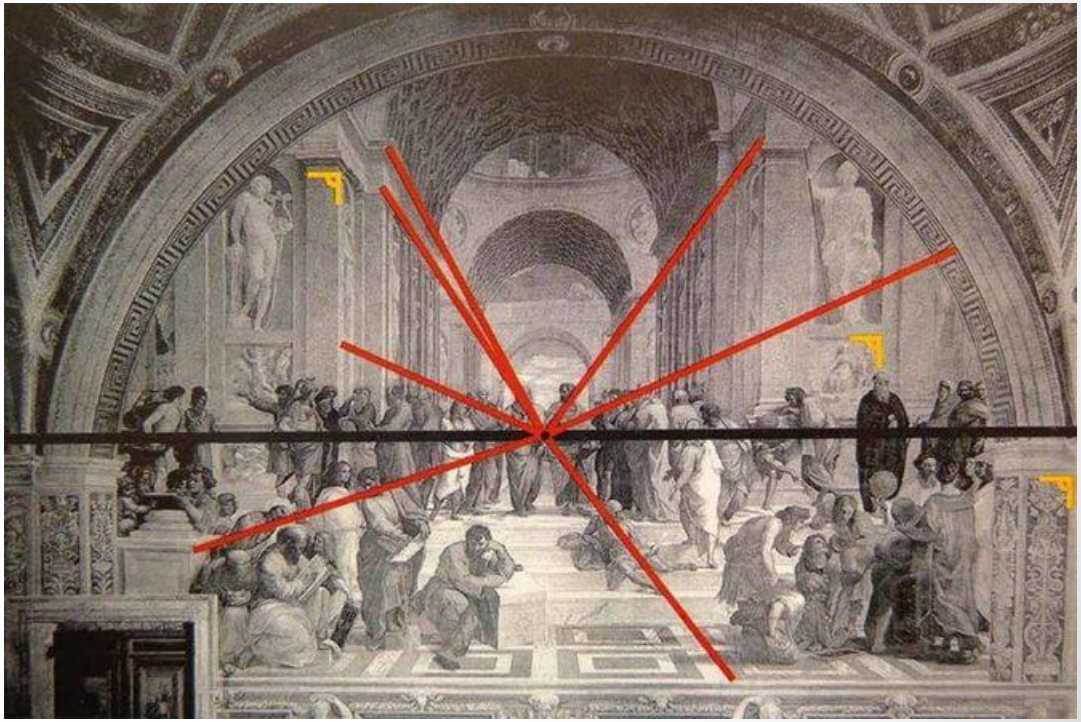
Artists of the late Middle Ages were interested in mathematics because they considered this science to be the ground of the entire physical world and it allowed them to correctly depict three-dimensional objects on a plane.

Perspective

The first beginnings of perspective appeared in the Italian artist Giotto and were developed thanks to the architect Filippo Brunelleschi.



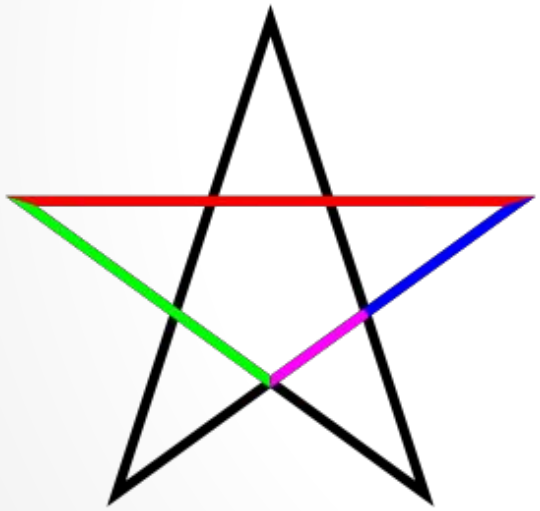
Giotto di Bondone



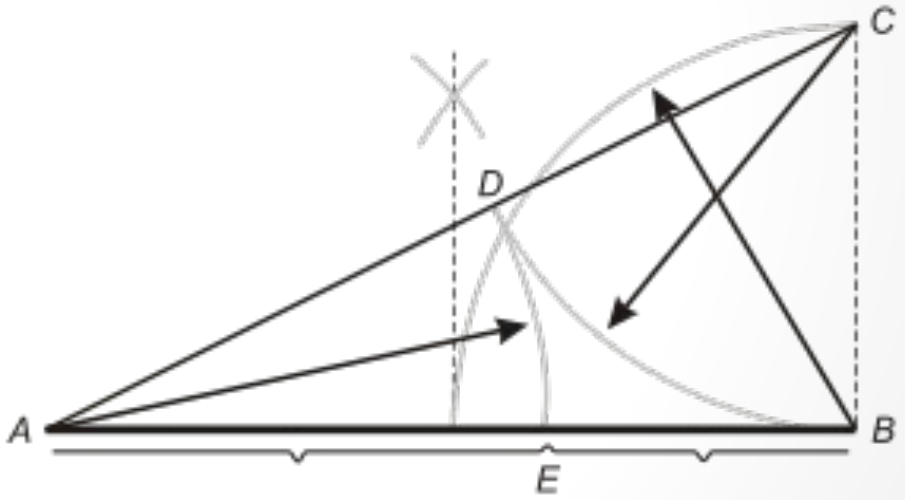
Fresco by Raphael Santi in the Stanza della Segnatura of the Vatican Palace

The golden section

The golden ratio is the only and best ratio of parts and the whole, in which the ratio of parts to the whole and the ratio of parts to each other are equal.

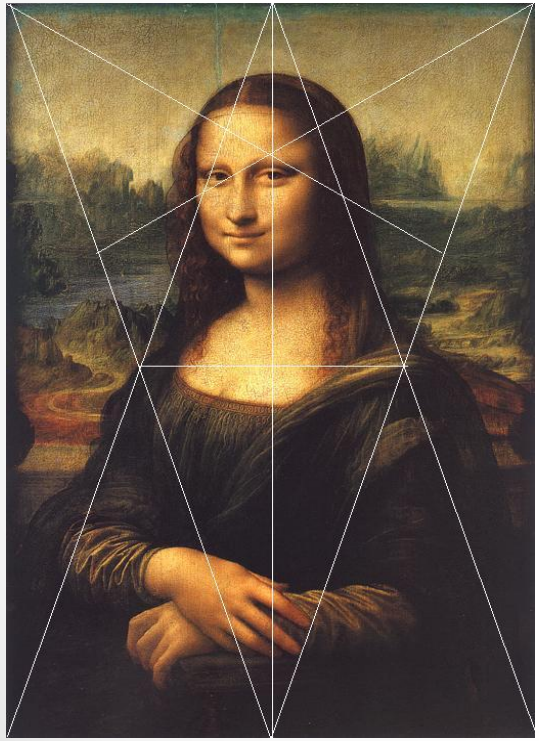


The golden section in a five-pointed star

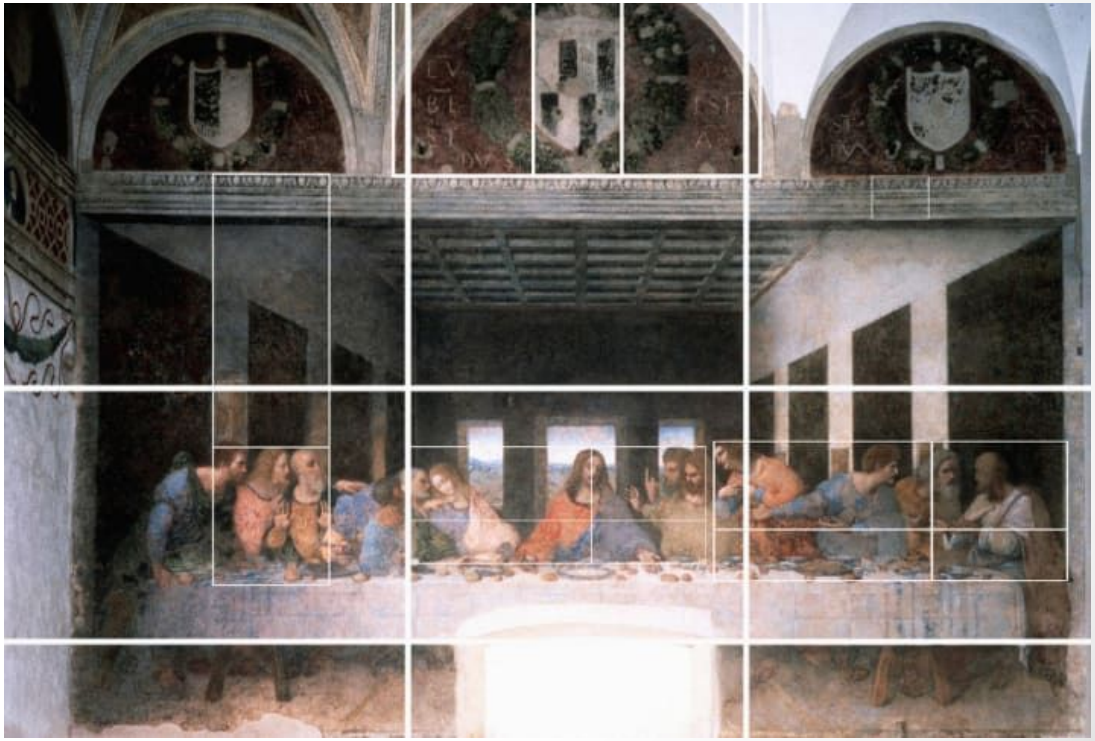


Building the Golden section

The golden ratio became very popular in the visual arts, because it allowed creating harmonious images that were pleasant to the viewer. One of the most famous artists who actively used the golden ratio was Leonardo da Vinci.



Mona Lisa



The Last Supper

Photography

With the advent of digital cameras in our lives, algorithms began to appear that allow us to automatically focus on objects. For example, contrast autofocus. The principle of working of this algorithm is very simple - the image in focus is more contrasting than not in it. Therefore, the camera goes through all the focusing options until it stops at the most suitable one.

Mathematical algorithms also allow you to process existing images. Thanks to post-processing, you can make a photo the way the user would like to see it.

1) Why are artists interested in mathematics?

2) What important things did Giotto di Bondone and Filippo Brunelleschi do?

3) What did Leonardo da Vinci often use in his works, such as the Mona Lisa and the Last Supper?

4) In what era did the demand for mathematical methods in the visual arts sharply increase?

5) What methods of autofocus do you know?