

6. Golden ratio

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Introduction. In mathematics, two quantities are in the golden ratio if their ratio is the same as the ratio of their sum to the larger of the two quantities. Expressed algebraically, for quantities a and b with $a > b$,

$$\frac{a + b}{a} = \frac{a}{b} = \varphi,$$

where the Greek letter phi represents the golden ratio. Its value is:

$$\varphi = \frac{1 + \sqrt{5}}{2} = 1.6180339887\dots$$

Some twentieth-century artists and architects, including Le Corbusier and Dalí, have proportioned their works to approximate the golden ratio—especially in the form of the golden rectangle, in which the ratio of the longer side to the shorter is the golden ratio—believing this proportion to be aesthetically pleasing (see Applications and observations below). Mathematicians since Euclid have studied the properties of the golden ratio, including its appearance in the dimensions of a regular pentagon and in a golden rectangle, which can be cut into a square and a smaller rectangle with the same aspect ratio. The golden ratio has also been used to analyze the proportions of natural objects as well as man-made systems such as financial markets, in some cases based on dubious fits to data.

Materials and Methods. The form in which lie the basis of constructing a combination of symmetry and the golden ratio, promotes the best visual perception and the emergence of feelings of beauty and harmony. The golden ratio is the highest manifestation of structural and functional perfection of the whole and its parts in art, science, technology and nature.

Results. Two quantities a and b are said to be in the golden ratio φ if:

$$\frac{a+b}{a} = \frac{a}{b} = \varphi.$$

One method for finding the value of φ is to start with the left fraction. Through simplifying the fraction and substituting in $b/a = 1/\varphi$,

$$\frac{a+b}{a} = 1 + \frac{b}{a} = 1 + \frac{1}{\varphi},$$

By definition, it is shown that

$$\varphi^2 - \varphi - 1 = 0.$$

Using the quadratic formula, two solutions are obtained:

$$\varphi = \frac{1 + \sqrt{5}}{2} = 1.618339887 \dots$$

Conclusions. In modern science, interest in the Golden Section has increased with new vigor. Golden Section proved a source of new and fruitful ideas in mathematics, theoretical physics and crystallography, economics, biology, botany, computer science, coding theory and cryptography. I believe that the study of the golden ratio opens wide horizons in modern science.

References.

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