

# The Golden Ratio

The Golden Ratio, or Divine Proportion, is a number known from ancient times, and found in art and architecture. The Greek letter  $\phi$  is often used to designate this quantity.

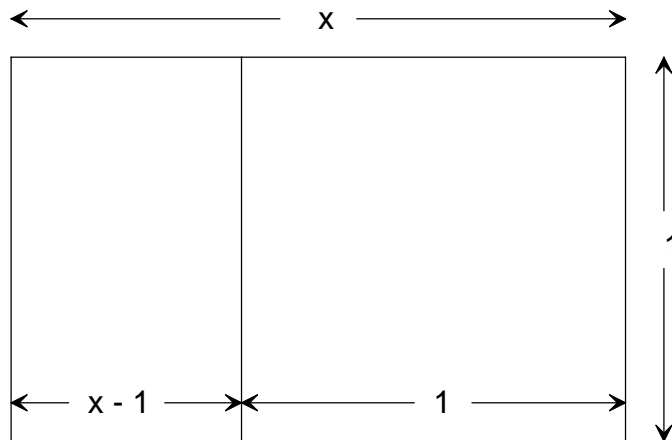
A line segment is divided into the Golden Ratio if the ratio of the length of the segment to the larger part equals the ratio of the larger part to the smaller part.



In the diagram above, the ratio  $\frac{AC}{AB}$  is equal to the ratio  $\frac{AB}{BC}$ .

There is a way to construct this ratio which will be discussed later.

Another way to look at this is that the Golden Ratio is the longer side of a rectangle with width 1 unit, having the property that if a square is removed from one end of the rectangle, the rectangle remaining has the same proportions. The letter  $x$  has been used for the ratio, for convenience.



The ratio  $\frac{x}{1}$  is equal to the ratio  $\frac{1}{x-1}$ . The equation  $\frac{x}{1} = \frac{1}{x-1}$ , gives  $x(x-1) = 1$ ,

$x^2 - x = 1$ ,  $x^2 - x - 1 = 0$ . This equation can be solved by a process of completing the square,

or by using the quadratic formula to get  $x = \frac{1 + \sqrt{5}}{2}$ , which is approximately 1.618033989

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The Golden Ratio is thought to be found in many works of art and architecture.

One example is the Parthenon, a temple located in Athens, Greece.

If the ruined roof is extended to its former height, the East end of the building, shown here in Figure 1, fits into a golden rectangle based at the ground level on the right.

Can you find other golden rectangles hidden in this structure?



Figure 1