

Note on golden ratio

Let us imagine a segment of a straight line having the length $a + b$ where $a > b$ and where segments of lengths a and b are chosen in such way that

$$\frac{a}{a+b} = \frac{b}{a} \quad (1)$$

The equation (1) can be rewritten as

$$a^2 - ba - b^2 = 0 \quad (2)$$

Its discriminant is $\Delta = b^2 - 4(-b^2) = 5b^2$.

$$a_1 = \frac{b + \sqrt{5}b}{2} \quad (3)$$

$$a_2 = \frac{b - \sqrt{5}b}{2} \quad (4)$$

The golden ratio ϕ is

$$\phi = \frac{a_1}{b} = \frac{1 + \sqrt{5}}{2} = 1.6180339887499 \quad (5)$$

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