

Student's Name

Instructor's Name

Course

Date

How the Golden Ratio Relates to Fibonacci Numbers

The golden ratio is a mathematical concept that was discovered more than 2400 years ago by Greek mathematicians. According to the concept, two numbers, a , and b , are deemed to be in the golden ratio if the quotient of the sum of the numbers, $(a + b)$, and the larger number is equal to the ratio of the larger number and the smaller number (Tung 7). Below is a mathematical elaboration of the golden ratio.

$$\varphi = \frac{a+b}{a} = \frac{a}{b} \text{ where } a > b$$

The value of the golden ratio is approximately 1.6, and, in most cases, it is represented by φ .

The golden ratio can be elaborately approximated using Fibonacci numbers.

The Fibonacci sequence is a set of numbers whereby each number in the sequence is the sum of the two preceding numbers. The Fibonacci sequence is generated from the function defined below.

$$F_n = F_{n-1} + F_{n-2}, n > 2$$

Using the function above, the first five Fibonacci numbers can be generated and are as presented below. It should be noted that the first two Fibonacci numbers are always 1.

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89

The concept of the golden ratio applies to Fibonacci numbers. From the third Fibonacci number, the ratio of the sum of two consecutive Fibonacci numbers is equal to the quotient of the large number to the smaller number (Meisner 39). Below is an illustration of how the golden ratio can be derived using the third and the fourth Fibonacci numbers.

$$F_{n1} = \frac{(2+3)}{3} = 1.666667$$

$$F_{n2} = \frac{3}{2} = 1.5$$

As evident above, the golden ratio F_{n1} is approximately equal to the number F_{n2} i.e.,

$F_{n1} \approx F_{n2}$. As the value of the Fibonacci numbers increases, the accuracy of the value of the golden ratio also increases.

The concept of the golden ratio and Fibonacci numbers are widely found in nature and have numerous applications. For instance, the petals of a sunflower exhibit the properties of the golden ratio. The greatest ancient musicians and composers, such as Ludwig van Beethoven, heavily employed the golden ratio and Fibonacci numbers to significantly increase the quality of their music.

Works Cited

Meisner, Gary B. *The Golden Ratio: The Divine Beauty of Mathematics*. Race Point Publishing, 2018.

Tung, K. K. *Topics in Mathematical Modeling*. Princeton University Press, 2007.