Believe It or Not : The Fibonacci Sequence

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ABSTRACT

The Fibonacci sequence is a mathematical series in which each number is determined by the sum of the previous two numbers. It was invented by Leonardo Fibonacci and has been found to accurately predict growth in living things. From the Fibonacci sequence comes the Golden Ratio, which can be used to calculate any Fibonacci number. We will explore its use in mathematics, where the golden ratio is used to solve various enumeration problems, and in nature, where seemingly unpredictable growth of plants, foods, and even animal breeding, can be determined all by the same sequence of predictable numbers.

BACKGROUND

Leonardo Fibonacci was an Italian mathematician from Pisa, born in 1175. When he was younger he traveled around the Mediterranean Coast, where he met with many merchants, one of whom was his father, Bonacci. As he grew up, he came to popularize the Hindu-Arabic numeral system through a book he wrote called *Liber Abaci,* translated as The Book of Calculations.

In *Liber Abaci*, Fibonacci solved a problem concerning rabbit population growth. Assuming an ideal situation concerning the growth, he created a sequence of numbers in which following generation by generation would create the sequence. This was later coined the Fibonacci sequence.

Although the earliest known usage of the sequence was in *Liber Abaci*, the sequence had apparently been used by Indian mathematicians from the sixth century and on without being labeled.

THE GOLDEN RATIO

When dividing two successive Fibonacci numbers, their ratio approaches the golden ratio.

$$\frac{1}{1}, \frac{2}{1}, \frac{3}{2}, \frac{5}{3}, \frac{8}{5}, \frac{13}{8}, \frac{21}{13}, \frac{34}{21}, \frac{55}{34}, \frac{89}{55} \ldots$$

= 1 , 2, 1.5, 1.67, 1.6, 1.625, 1.615, 1.7, 1.618, 1.6181…

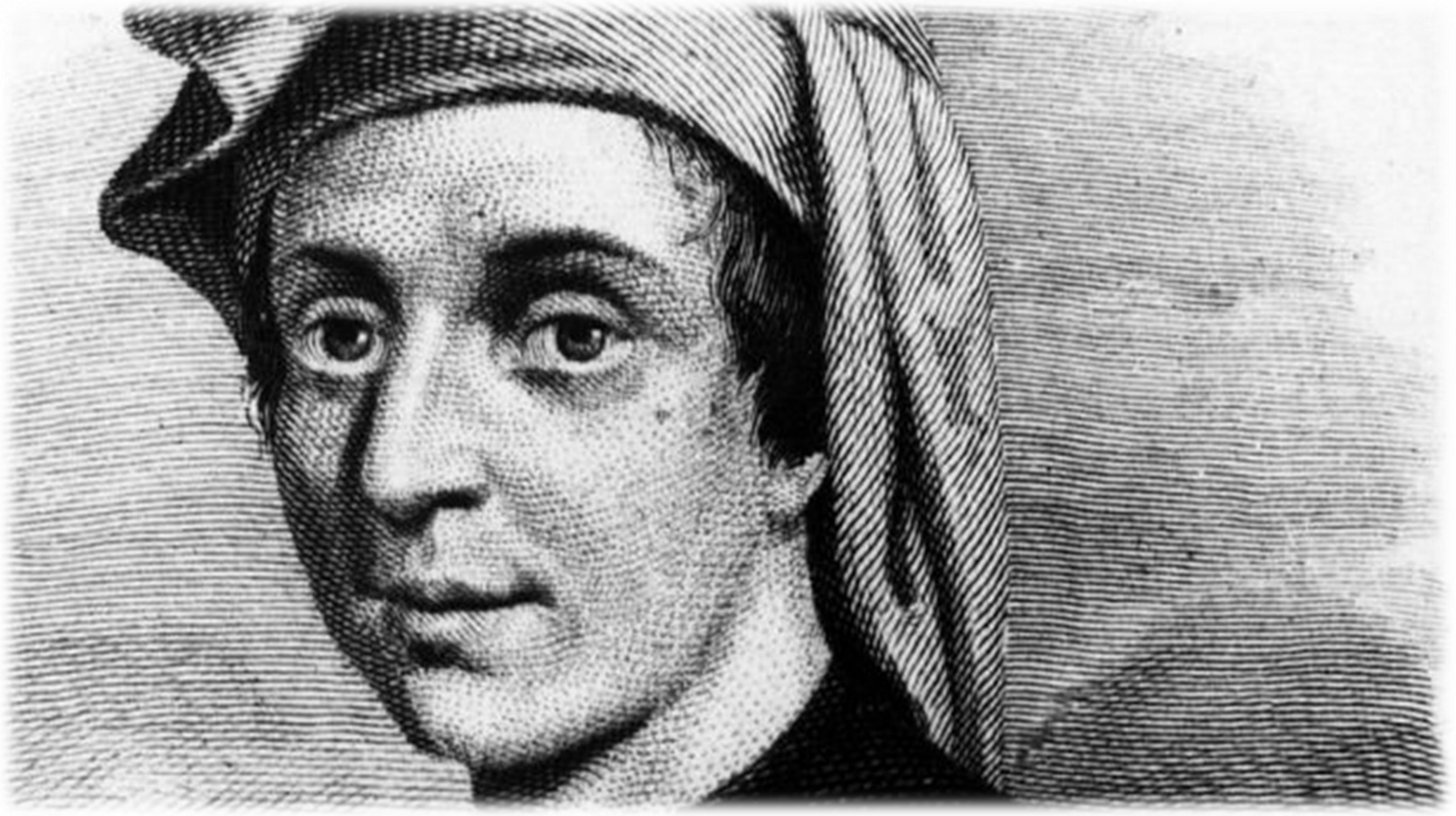
$$\varphi = 1.618034$$

Using the golden ratio to calculate any Fibonacci number:

$$x_n = \frac{\varphi^n - (1-\varphi)^n}{\sqrt{5}}$$

For example, to find the sixth Fibonacci number:

$$x_6 = \frac{\varphi^6 - (1-\varphi)^6}{\sqrt{5}} = 8$$



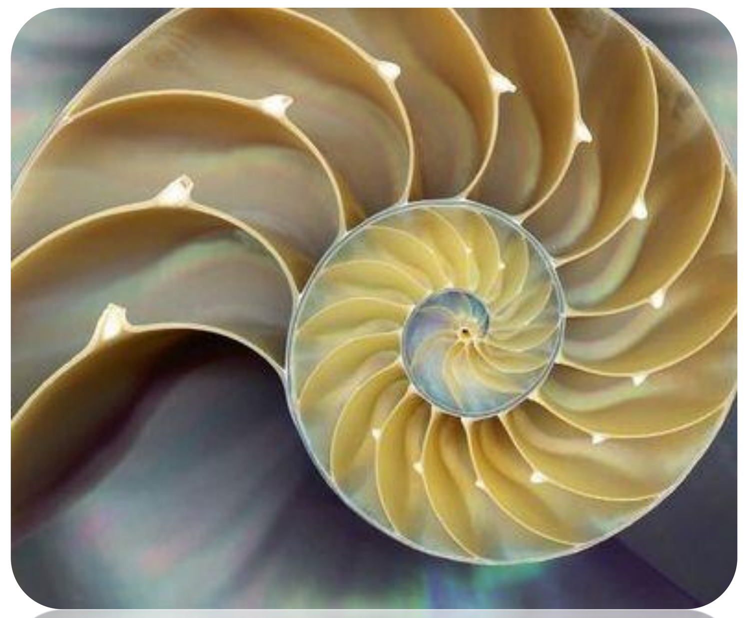
EXAMPLES IN REAL LIFE

Spiral can be found many places in nature

- Pattern of seeds on a sunflower
- Rabbits tend to breed according to the Fibonacci sequence
- Most flowers have a Fibonacci number as the number of petals they have
- Many snail and sea shells are in the shape of Fibonacci spirals
- Many pine cones are also in the shape of Fibonacci spirals

Mile to kilometer conversion is very close to the Fibonacci sequence.

For example,
8 mi. = 12.87 km.
Very close approximation to 13, the next number in the sequence.



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