

Fibonacci sequence, more than just numbers

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Have you ever noticed that the black keys in a piano are split in groups of three and two? How about that there are five black keys on a piano per octave? Or, that there are 13 notes in the span of any note's octave? Well, these aren't coincidences. This is not arbitrary. The numbers used to separate keys on a piano were, two and three for black keys, five total for black keys per octave, and 13 for the notes in the span of any notes octave. All of which are part of the Fibonacci sequence.

The Italian mathematician, Leonardo Pisano Bigollo, invented this sequence; Leonardo is also known as, Leonardo of Pisa (Pisano means from Pisa) or Fibonacci ("son of Bonacci). The Fibonacci sequence states that every term apart from the first two (0, 1) is the sum of the two preceding terms, or: $F_n = F_{(n-1)} + F_{(n-2)}$. For example, 0, 1, 1, 2, 3, 5, 8, 13, 21...

. However, this sequence is more than just a set numbers that follow a rule, it shows up in nature numerous times, like the earlier example with music. Many people have heard of this sequence, but few know about the true beauty of the Fibonacci sequence. The Fibonacci sequence also appears in many more places in nature, other than in music. For example, the spirals in a sunflowers seeds go counterclockwise and clock wise.

When you count the number of spirals the amount of clockwise and counterclockwise are consecutive Fibonacci numbers. This example also shows up in tapered pinecones, or pineapples. Many plants have patterns that can be traced back to the Fibonacci sequence. This will happen in many beautiful things, as our brains are hardwired to find the Fibonacci numbers

naturally pleasing. The Fibonacci sequence starts with, 0, 1, 1, 2, 3, 5, 8, 13, 21.

Now, try to divide the numbers of the Fibonacci sequence, the second one by the first, the third by the second, and so on. What do you get? $1/1 = 1$ $2/1 = 2$ $3/2 = 1.5$ $5/3 = 1.6666666...$

$8/5 = 1.6$ Notice anything? Each time we divide the numbers, it gets closer and closer to the golden ratio, which is: approximately 1.61803399. The Greeks believed the most beautiful rectangles, were to have dimensions that divided to the golden ratio. In the sunflower example, the number of seeds in the spirals were consecutive Fibonacci numbers, thus they divide to approximately the golden ratio. This could be a factor as to why Fibonacci numbers are common in wildlife.

Now, you may be thinking; why does this matter? Does this sequence only appear in nature? How does this help mankind? Well, apart from expanding our understanding of the universe, the Fibonacci sequence is used frequently in finance. Many times stock traders will attempt to foretell future share prices with the Fibonacci Retracement. The Fibonacci Retracement was named after their use in the Fibonacci sequence. This is just one example in which the Fibonacci sequence is applied in industries to help increase profit. The Fibonacci sequence is only one example of mathematics in every day life.

There are many more to be explored. For example, when architects design buildings they need formulas to calculate it's stability. Math is everywhere.

Just like the Fibonacci sequence, which appears many times in both nature and industry, you just have to keep your eyes peeled, and find them!