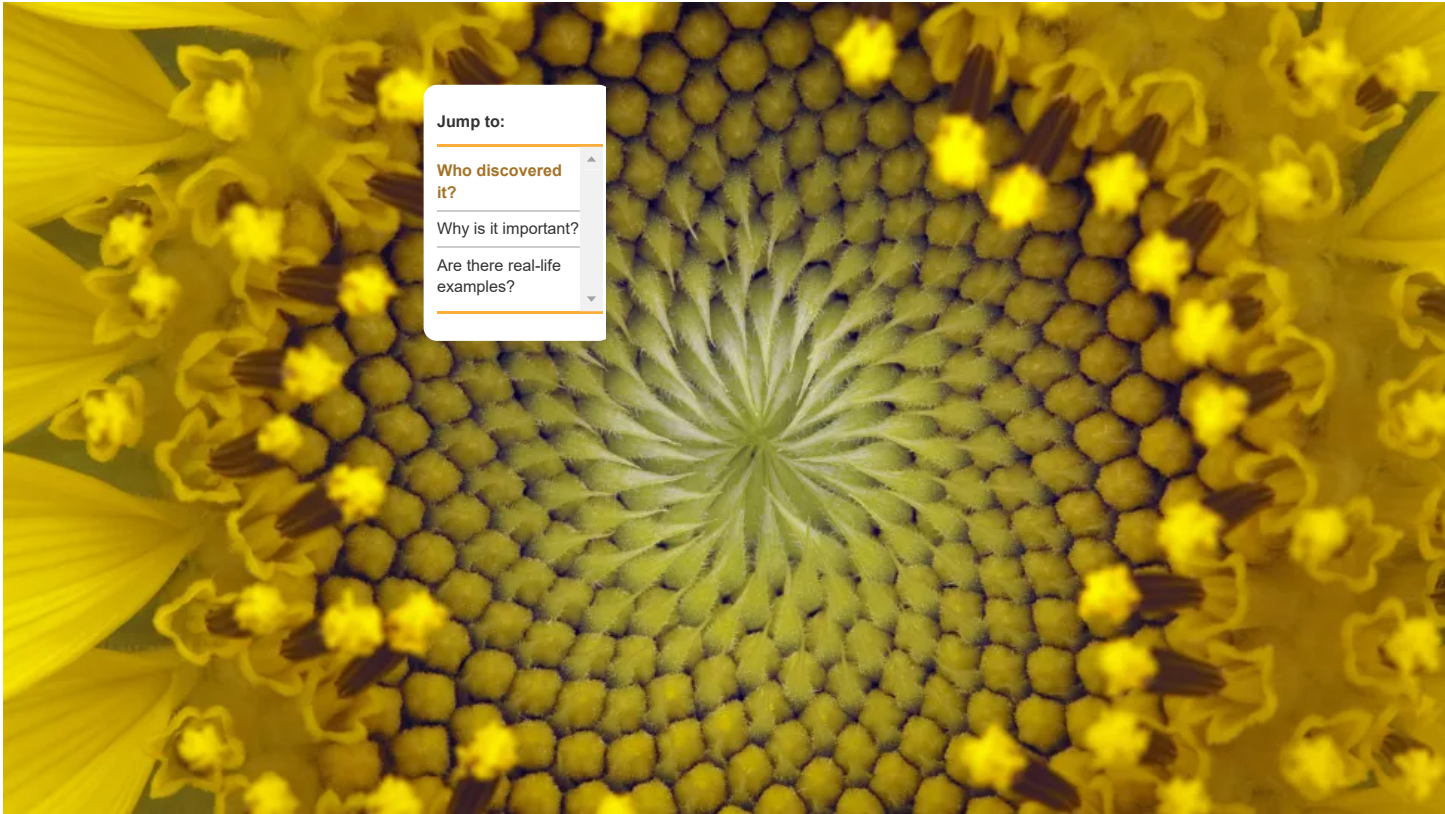


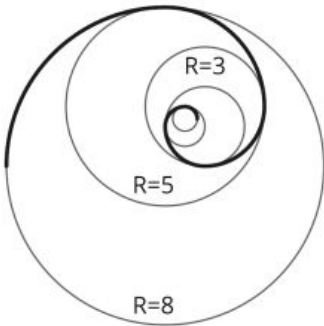
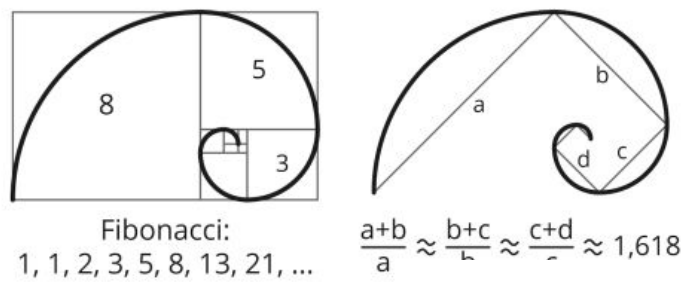
What is the Fibonacci sequence?

By Tia Ghose last updated March 01, 2023

From its origins to its significance, almost every popular notion about the famous Fibonacci sequence is wrong.



The seeds in a sunflower exhibit a golden spiral, which is tied to the Fibonacci sequence. (Image credit: belterz/Getty Images)



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WHO DISCOVERED THE FIBONACCI SEQUENCE?

The first thing to know is that the sequence is not originally Fibonacci's, who in fact never went by that name. The Italian mathematician who we call Leonardo Fibonacci was born around 1170, and originally known as Leonardo of Pisa, said Keith Devlin, a mathematician at Stanford University.

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Only in the 19th century did historians come up with the nickname Fibonacci (roughly meaning, "son of the Bonacci clan"), to distinguish the mathematician from another [famous Leonardo of Pisa](#), Devlin said.

Keith Devlin

Emeritus mathematician at Stanford University

Keith Devlin is an emeritus mathematician at Stanford University, a co-founder and co-founder of the Stanford mediaX research network, and a senior researcher emeritus. He is a World Economic Forum fellow, a fellow of the American Association for the Advancement of Mathematics, and a member of the American Mathematical Society. He has written 33 books and over 80 research articles.

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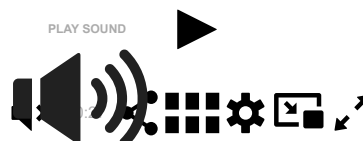
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Leonardo of Pisa did not actually discover the sequence, said Devlin, who is also the author of "The Forgotten Mathematical Genius Who Changed the World," (Princeton University Press, 2015). The sequence was first mentioned in 200 B.C. predating Leonardo of Pisa by centuries.

"It's been around forever," Devlin told Live Science.

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Portrait of Leonardo Fibonacci, who was thought to have discovered the famous Fibonacci sequence. However, in 1202 in a massive tome, he introduces the sequence with a problem involving rabbits. (Image credit: Stefano Bianchetti/Corbis via Getty Images)

However, in 1202 Leonardo of Pisa published the massive tome "Liber Abaci," a mathematics "cookbook for how to do calculations," Devlin said. Written for tradesmen, "Liber Abaci" laid out Hindu-Arabic arithmetic useful for tracking profits, losses, remaining loan balances and so on, he added.

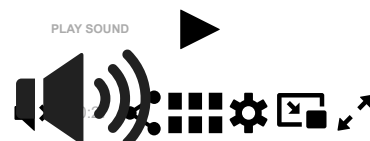
In one place in the book, Leonardo of Pisa introduces the sequence with a problem involving [rabbits](#). The problem goes as follows: Start with a male and a female rabbit. After a month, they mature and produce a litter with another male and female rabbit. A month later, those rabbits reproduce and out comes — you guessed it — another male and female, who also can mate after a month. (Ignore the wildly improbable biology here.) After a year, how many rabbits would you have?

The answer, it turns out, is 144 — and the formula used to get to that answer is what's now known as the Fibonacci sequence.

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"Liber Abaci" first introduced the sequence to the Western world. But after a few scant paragraphs on breeding rabbits, Leonardo of Pisa never mentioned the sequence again. In fact, it was mostly forgotten until the 19th century, when mathematicians worked out more about the sequence's mathematical properties. In 1877, French mathematician Édouard Lucas officially named the rabbit problem "the Fibonacci sequence," Devlin said.

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The Fibonacci sequence and the golden ratio are eloquent equations, but they aren't as magical as they may seem. (Image credit: Shutterstock)

WHY IS THE FIBONACCI SEQUENCE IMPORTANT?

Other than being a neat teaching tool, the Fibonacci sequence shows up in a few places in nature. However, it's not some secret code that governs the architecture of the universe, Devlin said.

It's true that the Fibonacci sequence is tightly connected to what's now known as [the golden ratio](#), [phi](#), an [irrational number](#) that has a great deal of its own dubious lore. The ratio of successive numbers in the Fibonacci sequence gets ever closer to the golden ratio, which is 1.6180339887498948482...

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The golden ratio manages to capture some types of plant growth, Devlin said. For instance, the spiral arrangement of leaves or petals on some plants follows the golden ratio. Pinecones exhibit a golden spiral, as do the seeds in a sunflower, according to "[Phyllotaxis: A Systemic Study in Plant Morphogenesis](#)" (Cambridge University Press, 1994). But there are just as many plants that do not follow this rule.

"It's not 'God's only rule' for growing things, let's put it that way," Devlin said.

ARE THERE REAL-LIFE EXAMPLES OF THE FIBONACCI SEQUENCE?

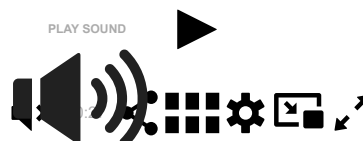
Perhaps the most famous example of all, the seashell known as the nautilus, does not in fact grow new cells according to the Fibonacci sequence, he added. When people start to draw connections to the [human body](#), art and architecture from tenuous to downright fictional.

"It would take a large book to document all the misinformation about the golden ratio from different authors," George Markowsky, a mathematician who was then at the University of Illinois Journal.

Much of this misinformation can be attributed to an 1855 book by the German psychologist Wilhelm Ostwald, who claimed the proportions of the human body were based on the golden ratio. In subsequent years, "golden triangles" and all sorts of theories about where these iconic dimensions crop up have been stated uncritically, Devlin said. All these claims, when they're tested, are measurably false, he added.

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Since then, people have said the golden ratio can be found in the dimensions of the Pyramid at Giza, the Parthenon, [Leonardo da Vinci's](#) "Vitruvian Man" and a bevy of Renaissance buildings. Overarching claims about the ratio being "uniquely pleasing" to the human eye have been stated uncritically, Devlin said. All these claims, when they're tested, are measurably false, he added.


"We're good pattern recognizers. We can see a pattern regardless of whether it's there or not," Devlin said. "It's all just wishful thinking."

Editor's note: Adam Mann contributed to this article.

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Tia is the managing editor and was previously a science writer for Live Science. Her work has appeared in Scientific American, Wired.com and other outlets. She holds a master's degree in science writing from the University of Washington, a graduate certificate in science writing from the University of Texas at Austin. Tia was part of a team at the Milwaukee Journal Sentinel that published a series on preterm births, which won multiple awards, including the 2012 Casey Medal for Meritorious Journalism.

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