The Fibonacci Sequence in God's Creation

A fascinating numerical property found in God's creation is called the Fibonacci sequence. It was popularized by Leonardo of Pisa in the thirteenth century. The sequence looks as follows:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377,....

Note that the third term is the sum of the first two, the fourth the sum of the second and third, and so on. These numbers are so common to creation that in 1963, *The Fibonacci Quarterly* began to be published by an organization called "The Fibonacci Association." The sole purpose of this publication is to document the occurrence of this sequence in nature!

The Fibonacci numbers occur repeatedly in the petal arrangement of flowers. For example, two petals are found on the enchanter's nightshade, three on the Trilium, Lily, and Iris, five on the Wild Geranium, Spring Beauty, and Yellow Violet, eight on the Lesser Celandine, Sticktight, and Delphinium, thirteen on the Corn Marigold, Mayweed, and Ragwort, twenty-one on the Chicory, Aster, and Helenium, thirty-four on the Plantain, Ox-eye Daisy, and Pyrethrum, fifty-five on the Field Daisy, Helenium, Michaelmas, and Daisy, and eighty-nine on the Michaelmas and Daisy.[1]

> *"I have come to believe that all the biological and physical phenomena of the universe have mathematical structure; humankind has only to discover them."*[2]

> *"Mathematics and science are activities of creative and imaginative human beings, not of computers or other machines. The creativity and imagination must be controlled by discipline and self-criticism, but that is equally true of other kinds of creative activity such as the writing of poetry. And because it is a creative and imaginative activity, there are satisfactions in engaging in it no different from those felt by creative artists in their work, and there is a beauty in the results that can be enjoyed by others in the same way that poems, pictures, and symphonies are."*[3]

These numbers are found in the spiral arrangement of petals, pine cones, and pineapples. In the pine cone spiral, there are five spirals one way and eight the other. In pineapple spirals, the pair one way and the other can be five and eight, or eight and thirteen. In the sunflower spirals, the combination can be eight and thirteen, twenty-one and thirty-four, thirty-four and fifty-five, fifty-five and eighty-nine, and eighty-nine and hundred forty-four.

The phyllotaxis of trees exhibit the Fibonacci number in a unique way. The spiraling pattern is seen in the turning of leaves about the stem. Starting from a given leaf at a specific position, the number of turns required to find another leaf in the same position is a Fibonacci number. Also, the number of leaves between and within those turns is a Fibonacci number! For example, in the basswood and elm, the ratio of turns to leaves is 1:2, in the hazel and beech, the ratio is 1:3, in the apricot, cherry and oak it is 2:5, in the pear and poplar it is 3:8, and in the almond and pussy willow it is 5:13.[4]

The Fibonacci number also finds its home in the study of rabbit populations, the genealogy of male bees and in quantum mechanics.[5]

In music, the basic structure of a piano keyboard consists of an octave of *thirteen* notes, *eight* of which are white and *five* of which are black. The black keys come in groups of *two* and *three*!

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1 LeRoy C. Dalton, *Algebra in the Real World* (Palo Alto: Dale Seymour Publications, 1983), p. 75.

2 *Ibid*., p. vi.

3 Martin Goldstein and Inge F. Goldstein, *How We Know* (New York: Plenum Press, 1978), p. 4.

4 Dalton, p. 75.

5 H. E. Huntley, *The Divine Proportion: A Study in Mathematical Beauty* (New York: Dover Publications, 1970), pp. 156-161.

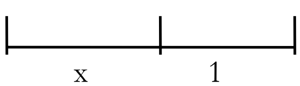
We have yet to scratch the surface of the Fibonacci numbers. Starting with the second and third terms of the series {1, 2}, we can calculate the ratio between terms and come up with the following:

2:1 = 2.0
3:2 = 1.5
5:3 = 1.67
8:5 = 1.6
13:8 = 1.625
21:13 = 1.6153846
34:21 = 1.6190476
55:34 = 1.617647
89:55 = 1.6181818
144:89 = 1.6179775
233:144 = 1.6180555
377:233 = 1.6180257

We can see that the sequence of ratios approaches the number 1.618. Using mathematical terms, the limit of the sequence of ratios in the sequence of Fibonacci numbers is 1.618.

This number is called φ, the Greek letter phi, which is the first letter of the name of the Greek sculptor Phidias who consciously made use of this ratio in his work.

This number is also equal to the division of a line segment into its extreme and mean ratio. That is, given a line segment below:



The extreme and mean ratio is: $x/1 = (x + 1)/x$. Cross multiplying we get: $x^2 = x + 1$. Solving for x and applying the quadratic formula, we get: $x = (1 \pm \sqrt{5})/2$. Solving for positive x, $x=1.618033989 = \varphi$!

This number φ has been called the golden ratio. Since it has so many applications in God's creation, scientists like Kepler nicknamed it the "Divine Proportion."

The Divine Proportion finds acute application in the pentagram. In the pentagram, the ratio of AC to AB is equal to φ! God's creation is replete with five-petaled flowers. A few are the hibiscus, wild geranium, spring beauty, wood sorrel, yellow violet, plumeria, saxifrage, wild rose, pipsissewas, bellflower, filaree, hoya plant, columbine, cinquefoil, chickweed, and passion flower.[6]

Also, the starfish, the sand dollar, the cross section of an apple core, and a wide variety of marine animals all reflect the pentagramic form of the Divine Proportion.

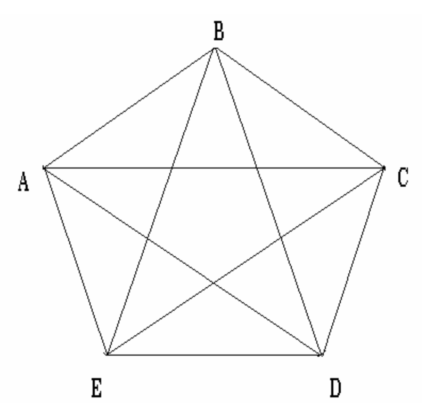


Figure 1: The Pentagram

In a golden rectangle (also called golden section), the ratio of the length to the width, BH/BA, is φ. To construct such a rectangle, begin with a square ABCD. Divide the square into two equal parts by the dotted line EF. Point F is the center of a circle whose radius is the diagonal FC. Draw an arc of the circle (CG) and extend the base line AD to intersect it. This becomes the base, AG, of the rectangle. Draw the new side, HG, at right angles to the new base, bringing the line BH to meet it. The resultant golden rectangle has one unusual property: If

6 Dalton, p. 70.

the original square is taken away, what remains will still be a golden rectangle!

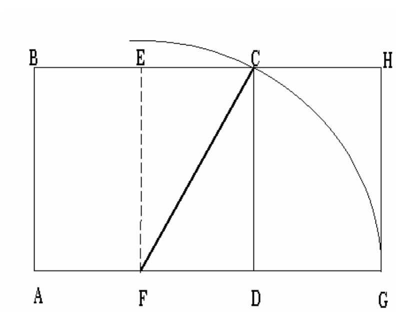


Figure 2: The Golden Rectangle

The golden rectangle is said to be one of the most visually satisfying of all geometric forms; it appears repeatedly in art and architecture.

The geometric shape of the chambered nautilus is called the logarithmic, or equiangular, spiral. This shape can be constructed using Fibonacci numbers. First, draw a golden rectangle as described above. Divide the rectangle into a series of squares as shown in figure 3. Draw an arc that is a quarter circle from a corner of each square, starting with the largest square, to form a continuous curve. The resulting curve is close to the shape of the chambered nautilus!

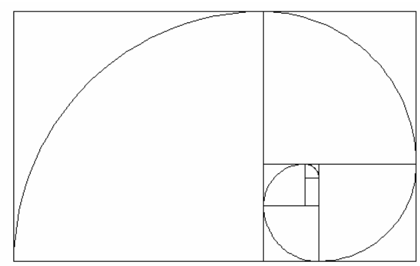


Figure 3: The Chambered nautilus

Beauty in mathematics must tell us something about the universe and its Creator. Both Copernicus and Kepler believed that theories in astronomy should be beautiful and that as they discovered more of that beauty it gave evidence of the greatness and character of God.

Kepler said, "Great is our Lord and great His virtue and of His wisdom there is no number: praise Him, ye heavens, praise Him, ye sun, moon, and planets, use every sense for perceiving, every tongue for declaring your Creator. Praise Him, ye celestial harmonies, praise Him, ye judges of the harmonies uncovered ... and thou my soul, praise the Lord thy Creator, as long as I shall be: for out of Him and through Him and in Him are all things.... To Him be praise, honor, and glory, world without end. Amen."[7]

Elton Trueblood has said, "If the world is the creation of Infinite Mind, the prodigious beauty of the world makes sense. In short, if theism is true, the aesthetic experience of natural beauty is what we should expect to find."[8]

It has been said, "Mathematics is all around us. We only need to look." May God continue to use the Christian mathematics classroom as a medium through which students can *look* at the mathematical wonders of His creation.

[7] Johannes Kepler, "The Harmonies of the World," in *Great Books of the Western World: Ptolemy, Copernicus, Kepler*, edited by R. M. Hutchins (Chicago: Encyclopaedia Britannica, 1952), 16:1085.

[8] Elton Trueblood, *Philosophy of Religion* (New York: Harper & Row Publishers, 1957), p. 130.