A Spiritual Side to Mathematics?

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The Problem

Oh God, how can we know You? You are as familiar to us as breathing, yet You are farther than the farthermost star. You are as mysterious as the vast solitude of night, yet as familiar to us as the light of the sun. Where can we find You?
My Sweet Lord
I really want to see you
Really want to be with you
Really want to see you lord
But it takes so long, my lord

George Harrison
God said to Moses: You cannot see my face, but I will make all my goodness pass before you.
DANCING IN THE FOOTSTEPS OF EVE

Retrieving the healing gift of the Sacred Feminine for the human family through myth and mysticism

Heather Mendel
Spiritual Principles:
We are all one.
We are all one with God.

My Experience: I feel separate.
Spirituality

Spirituality is the light from the flames of life that warms our existence and connects us to each other, and the centrality of the fire that is Divinity.

Heather Mendel
THE FIRST DAY OF CLASS
Number Sequences and Inductive Reasoning

Sequence of Odd Numbers
1, 3, 5, 7, . . .

Sequence of Squares
1, 4, 9, 16, . . .
Odds: 1, 3, 5, 7, . . .
Squares: 1, 4, 9, 16, . . .

\[
\begin{align*}
1 & = 1 = 1^2 \\
1 + 3 & = 4 = 2^2 \\
1 + 3 + 5 & = 9 = 3^2 \\
1 + 3 + 5 + 7 & = 16 = 4^2 \\
1 + 3 + 5 + 7 + 9 & = 25 = 5^2
\end{align*}
\]
Once we have this relationship, it bonds us with each other. And it passes back and forth between us without ambiguity. Unlike other things we communicate about:

When we communicate about our senses,

Try this kale, it tastes really good!

or our feelings

I'm feeling a little sad

we have no idea what the other person is experiencing.
Introduction I thought about the origin of all square numbers and discovered that they arise out of the increasing sequence of odd numbers; for the unity is a square and from it is made the first square, namely 1; to this unity is added 3, making the second square, namely 4, with root 2; if to the sum is added the third odd number, namely 5, the third square is created, namely 9, with root 3; and thus sums of consecutive odd numbers and a sequence of squares always arise together in order.
Mathematics Transcends Language and Translation
Odds: 1, 3, 5, 7, . . .
Squares: 1, 4, 9, 16, . . .

\[ 1 = 1 = 1^2 \]
\[ 1 + 3 = 4 = 2^2 \]
\[ 1 + 3 + 5 = 9 = 3^2 \]
\[ 1 + 3 + 5 + 7 = 16 = 4^2 \]
\[ 1 + 3 + 5 + 7 + 9 = 25 = 5^2 \]
I think we have the first part covered!

**Spirituality**

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Heather Mendel
What's the best part of being a mathematician? I'm not a religious man, but it's almost like being in touch with God when you're thinking about mathematics. God is keeping secrets from us, and it's fun to try to learn some of the secrets.

Paul R. Halmos
1916 - 2006
We may have the second part covered!

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Paul R. Halmos
1916 - 2006

He believed that mathematics was a creative art; that mathematicians should be seen as artists, not number crunchers.
It is impossible to be a mathematician without being a poet in soul.
The true spirit of delight, the exaltation, the sense of being more than Man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as poetry.

Bertrand Russell
Fibonacci Sequence

1, 1, 2, 3, 5, 8, . . .

Application  The number of bees in the family tree of a male honey bee.
Application: The family tree of a male honey bee.
There are many other ways in which the Fibonacci sequence, and Fibonacci numbers, are used to describe, and classify, events and items in the world around us.
The Fibonacci sequence is here, now.

How long has it been around?

Before there were bees, or the stock market?

How long will it last?
We cannot teach people anything; we can only help them discover it within themselves

-Galileo Galilei

Built the first telescope in 1609

Discovered the moons of Jupiter in 1610
The kingdom of God is within you.

Jesus

The Buddhists quote Jesus. He is considered to be an enlightened person and a spiritual teacher.
More about Galileo

When Galileo discovered he could use the tools of mathematics and mechanics to understand the motion of celestial bodies, he felt that he had learned the language in which God recreated the universe.

Today we are learning the language in which God created life. We are gaining ever more awe for the complexity, the beauty, the wonder of God's most divine and sacred gift.

William Jefferson (Bill) Clinton
Back to Class

Are some rectangles more attractive than others?
The Golden Rectangle

Golden Ratio \( \frac{L}{W} = \frac{1+\sqrt{5}}{2} \approx 1.618 \)
Approaching the Golden Rectangle with the Fibonacci Sequence
The most common mistake in first year algebra:

\[(a + b)^2 = a^2 + b^2\]

\[(3 + 4)^2 = 3^2 + 4^2\]

\[7^2 = 9 + 16\]

\[49 = 25\]

The correct formula is:

\[(a + b)^2 = a^2 + 2ab + b^2\]
Binomial Squares in Korean
BINOMIAL EXPANSIONS

\((x + y)^0 = 1\)

\((x + y)^1 = 1x + 1y\)

\((x + y)^2 = 1x^2 + 2xy + 1y^2\)

\((x + y)^3 = 1x^3 + 3x^2y + 3xy^2 + 1y^3\)

\((x + y)^4 = 1x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + 1y^4\)

\((x + y)^5 = 1x^5 + 5x^4y + 10x^3y^2 + 10x^2y^3 + 5xy^4 + 1y^5\)
Pascal's Triangle
The Connection Between Pascal’s Triangle and the Fibonacci Sequence
'PASCAL' TRIANGLE 12TH CENTURY AD

A DIAGRAM OF FROM 'PRECIOUS MIRROR OF THE FOUR ELEMENT' PUBLISHED IN 1303
The first time an event occurs in nature it is called a miracle; later it comes to seem natural and is taken for granted.

Baal Shem Tov
1698-1760
Truly I tell you, unless you change and become like little children, you will never enter the kingdom of heaven.

Jesus

…but I was so much older then, I’m younger than that now

Bob Dylan

My Back Pages
This is not the number 5
Mathematics is a game played according to certain simple rules with meaningless marks on paper.

David Hilbert
Nothing has afforded me so convincing a proof of the unity of the Deity as these purely mental conceptions of numerical and mathematical science.
Sierpinski Triangle

If the area of the shaded region in Stage 0 is 1, find the area of the shaded region in the other stages.
Sierpinski Triangle
Mandelbrot Set
Barnsely Fern
Julia Set

Himalayas from Space
Sierpinski Pyramids
Hungary, 1996
Fractal Landscape
An equation for me has no meaning, unless it represents a thought of God.
The ink of the scholar is more holy than the blood of the martyr

The Prophet Muhammad
Is there a God?

How should I know? I don’t understand how a can opener works!

Woody Allen
But with mathematics, we escape the limitations of our perceptions and senses. We can work in four dimensions, we understand why cats have better visions than we do, and we can build machines that let us see what a cat sees.
Stephen Hawking

If we find the answer [the unified theory], it would be the ultimate triumph of human reason -- for we would know the mind of God.
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Heather Mendel
Functions

\[ y = 2x \]

\[ f(x) = 2x \]

\[ f(4) = 2(4) = 8 \]

\[ g(x) = x^2 \]

\[ g(4) = 4^2 = 4 \cdot 4 = 16 \]
Iterated Functions

Definition  If $x$ is in the domain of $f$, then the sequence below is called an *orbit* of $x$ for $f$.

$$x, \ f(x), \ f(f(x)), \ f(f(f(x))), \ldots$$

Regular Function

Iterated Function
Find the orbit of 1 for $f(x) = 2x - 1$

$f(1) = 2(1) - 1 = 2 - 1 = 1$

$f(f(1)) = f(1) = 2(1) - 1 = 2 - 1 = 1$

$f(f(f(1))) = f(1) = 2(1) - 1 = 2 - 1 = 1$

$f(f(f(f(1)))) = f(1) = 2(1) - 1 = 2 - 1 = 1$

Next? 1
More Orbits of Iterated Functions

Find the orbit of 1 for \( f(x) = 3x - 2 \)

\[ 1, 1, 1, 1, \ldots \]

Find the orbit of 1 for \( f(x) = \sqrt{1+x^2} \)

\[ 1, \sqrt{2}, \sqrt{3}, \sqrt{4}, \sqrt{5}, \ldots \]

Find the orbit of 1 for \( f(x) = 1 + \frac{1}{x} \)

\[ \overline{2}, \overline{3}, \overline{5}, \overline{8}, \ldots \]

\[ \frac{1}{1}, \frac{2}{2}, \frac{3}{3}, \frac{5}{5}, \ldots \]
The Barnsley fern $b_2 = 4.5800$ scale = 0.712
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The End