

Is Mathematics Beautiful?

If It Is,

**Is It Because God Is A
Mathematician?**

When the famous mathematician Gauss was a child, his teacher, trying to keep him busy, set him on the task of finding the sum of the whole numbers 1 to 100.

His teacher was shocked when he completed the problem in just a few seconds.

$$\begin{array}{r} 1 + 2 + 3 \dots + 50 \\ 100 + 99 + 98 \dots + 51 \\ \hline \end{array}$$

$$101 + 101 + 101 + 101$$

$$50 \times 101 = 5050$$



Why are numbers beautiful? It's like asking why is Beethoven's Ninth Symphony beautiful. If you don't see why, someone can't tell you. I know numbers are beautiful. If they aren't beautiful, nothing is.

— *Paul Erdos* —

AZ QUOTES

Paul Erdos

God used beautiful
mathematics in creating the
world.

Paul Dirac



 BrainyQuote

Paul Dirac

$$(i\hat{\phi} - m)\psi = 0$$

Dirac's Equation



"For since the fabric of the universe is most perfect and the work of a most wise Creator, nothing at all takes place in the universe in which some rule of maximum or minimum does not appear."

Leonhard Euler

Euler's Identity

$$e^{i\pi} + 1 = 0$$

SOME BEAUTY FROM NUMBER THEORY

- Who was Fibonacci?

Leonardo Pisano (Leonardo of Pisa) (right), better known as Fibonacci, was an Italian mathematician who is most famous for his **Fibonacci Sequence** and for popularizing the Hindu-Arabic numeral system in Europe.

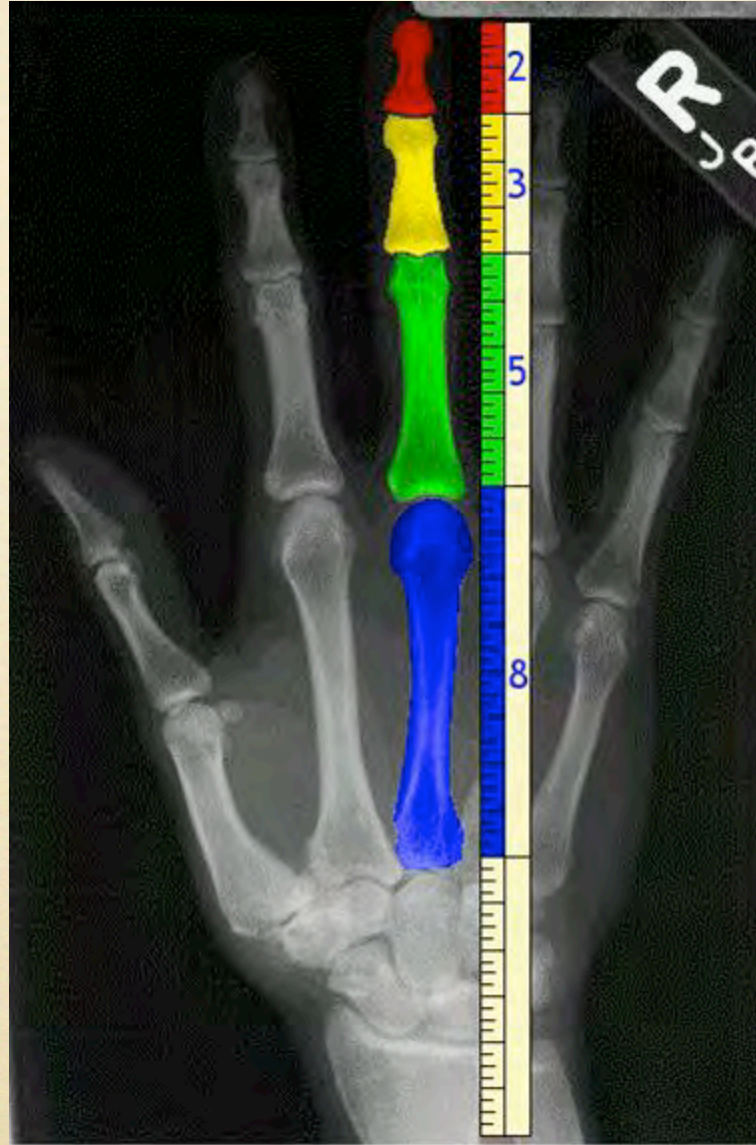


Fibonacci

- What are the next 3 terms of the Fibonacci Sequence?

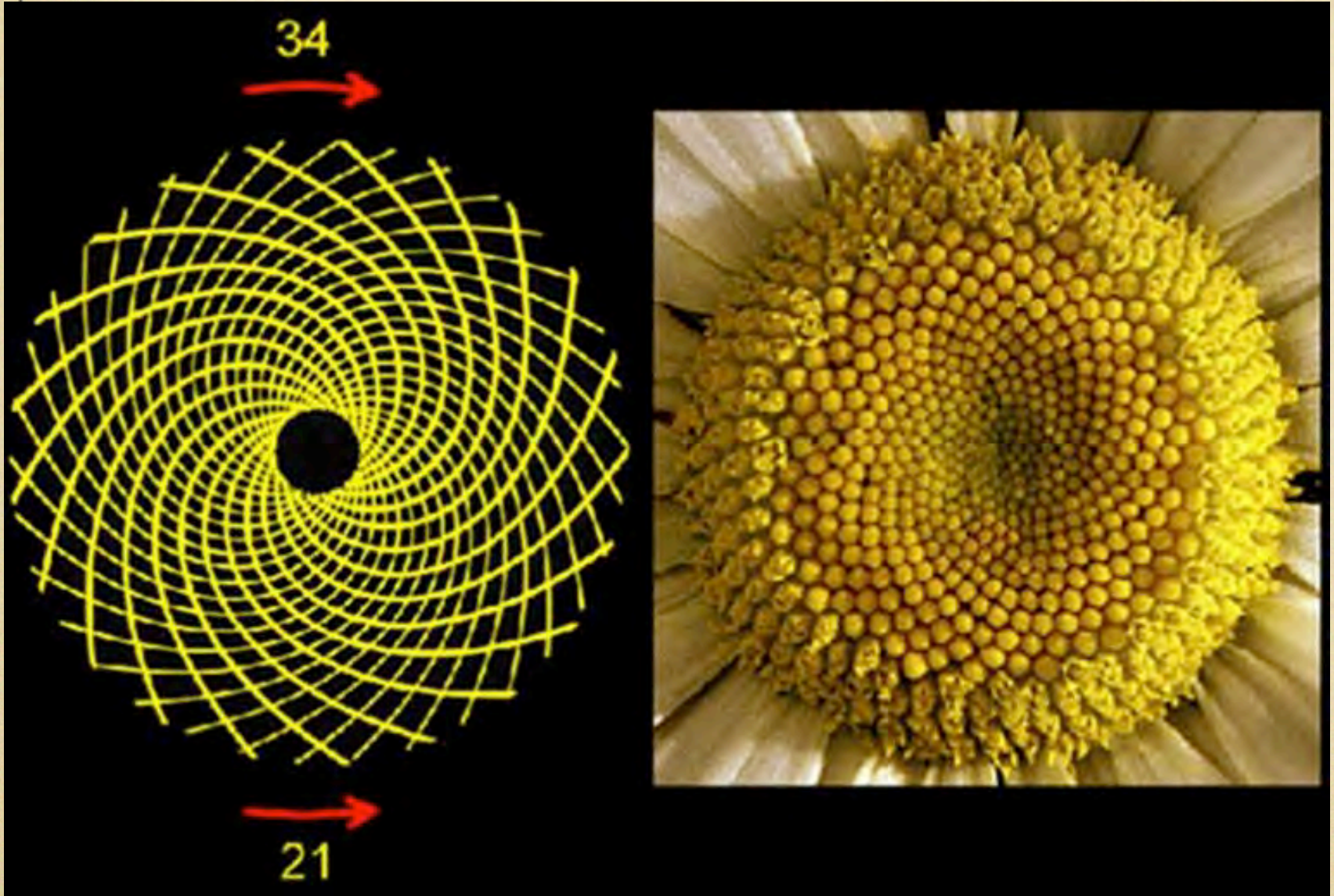
1, 1, 2, 3, 5, 8, 13, 21, 34, ...

The Fibonacci Sequence in Nature- Humans(cm)

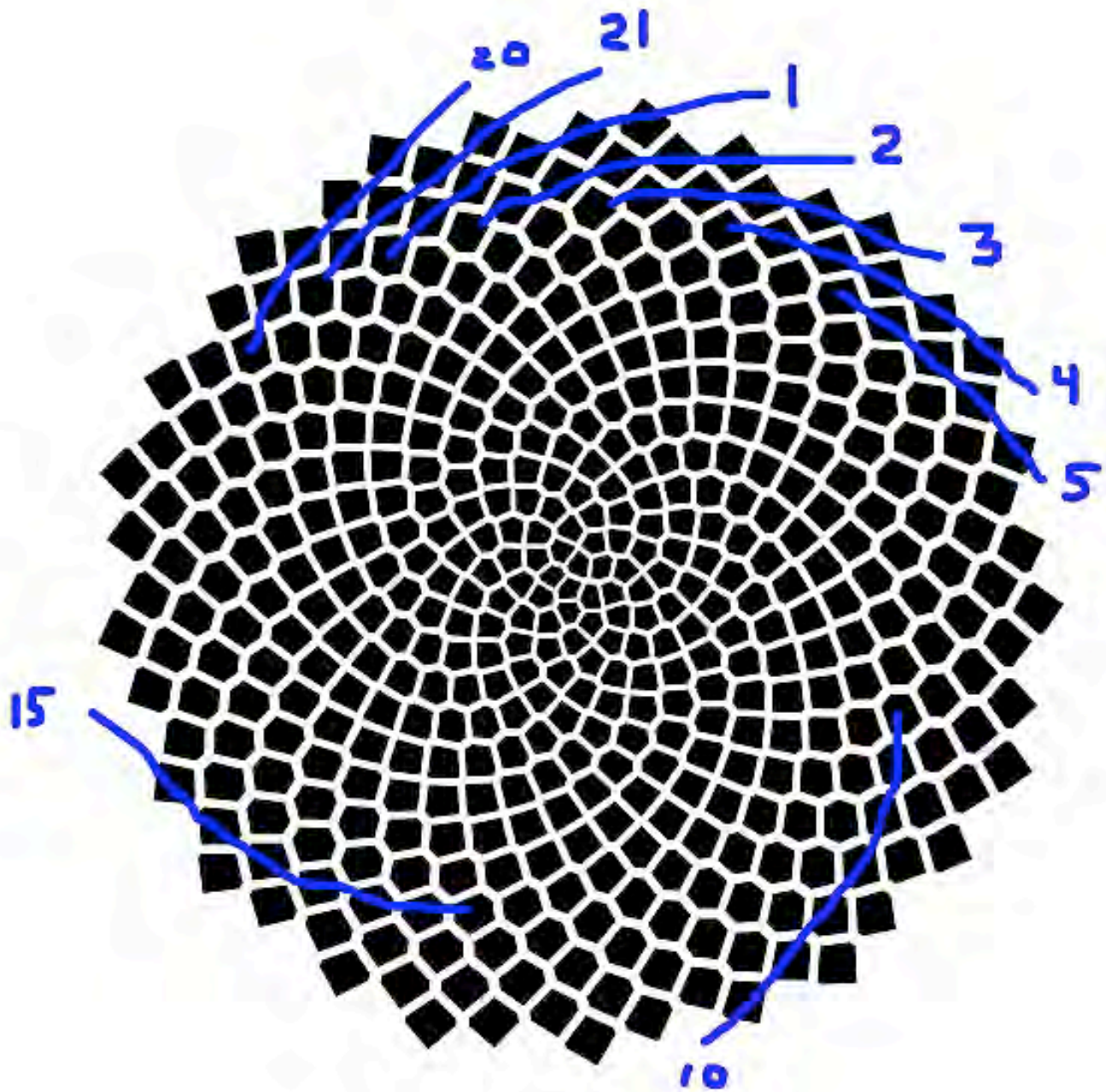


1, 1, 2, 3, 5, 8, 13, 21, 34, 55

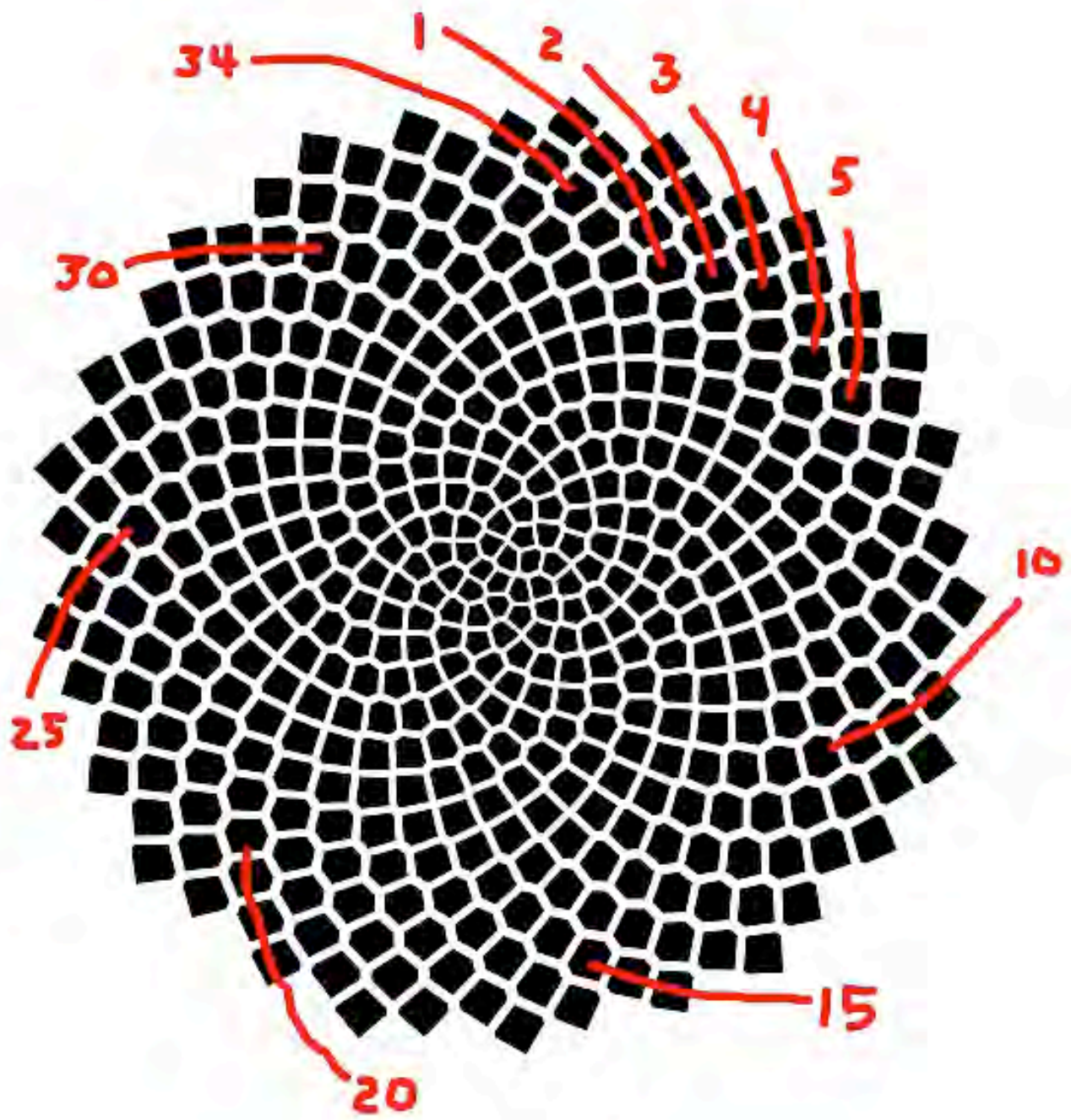
The Fibonacci Sequence in Nature- Sunflowers



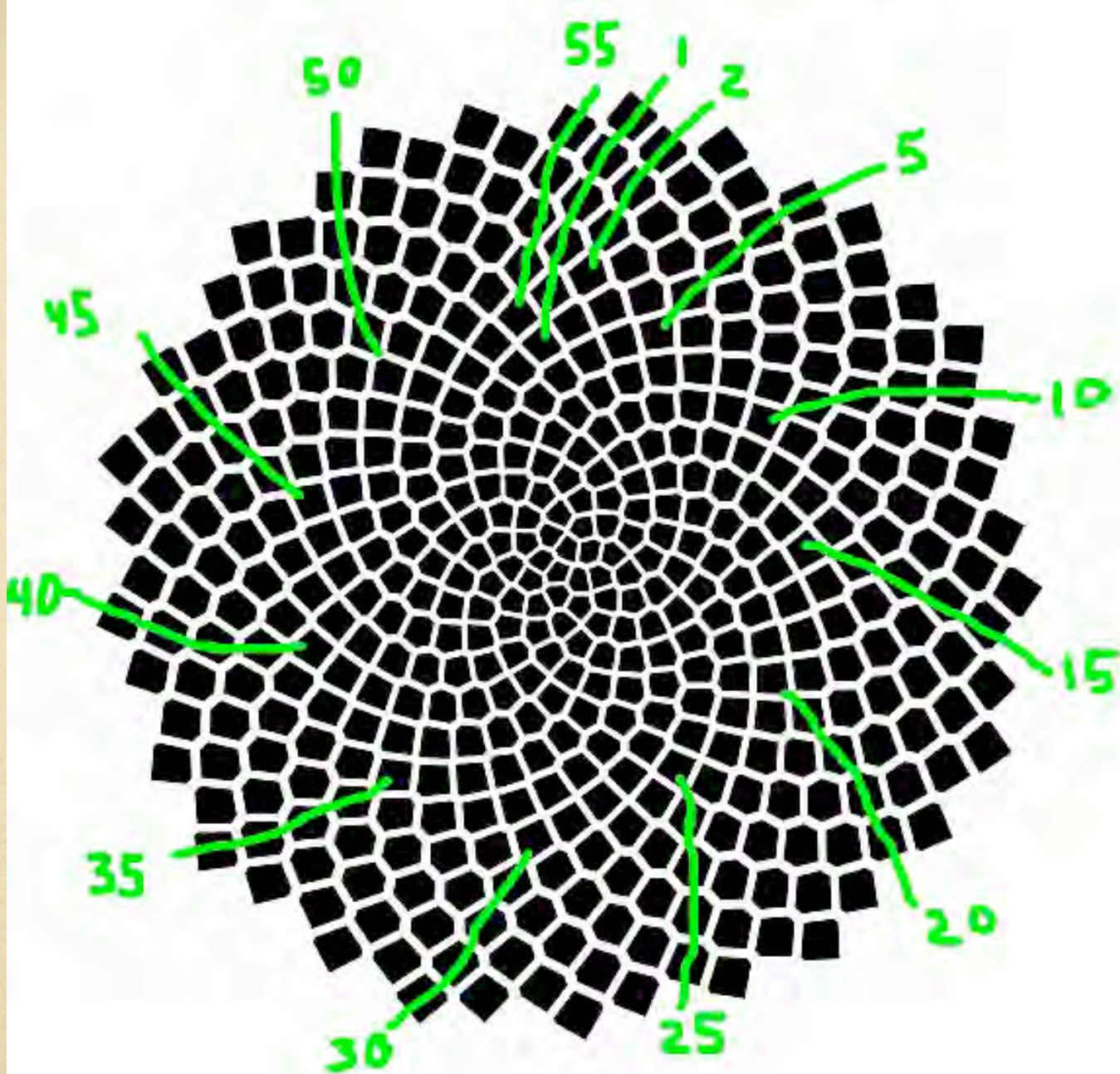
1, 1, 2, 3, 5, 8, 13, 21, 34, 55



1, 1, 2, 3, 5, 8, ⁹13, 21, 34, 55

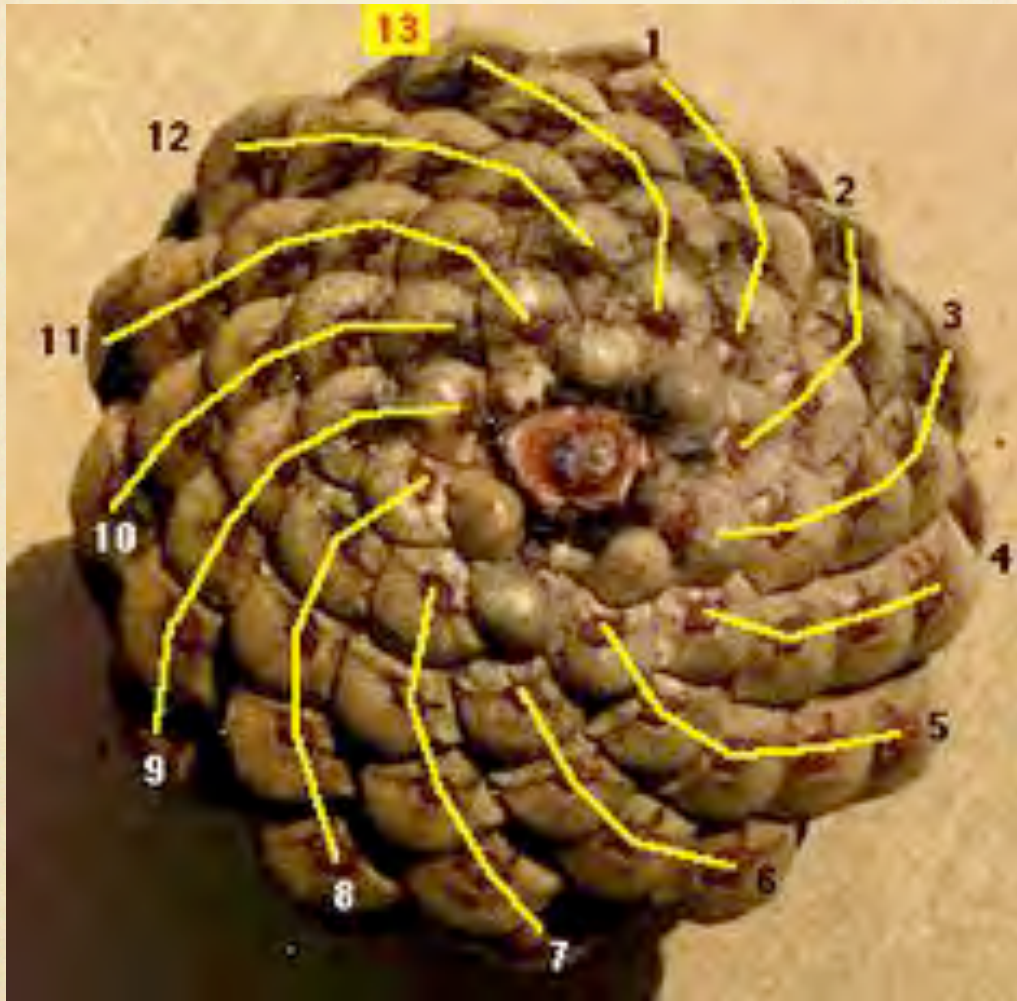


1, 1, 2, 3, 5, 8, 13, 21, 34, 55



1, 1, 2, 3, 5, 8, 13, 21, 34, 55

The Fibonacci Sequence in Nature- Pine Cones



1, 1, 2, 3, 5, 8, **13**, 21, 34, 55

The Fibonacci Sequence in Nature- Flower Petals

1



2



3



5



8



13



21



34



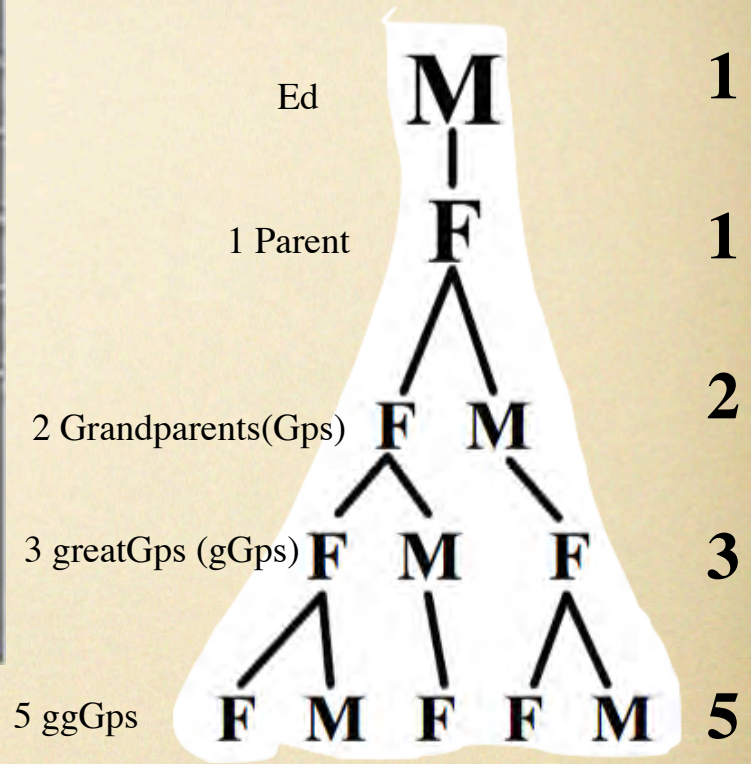
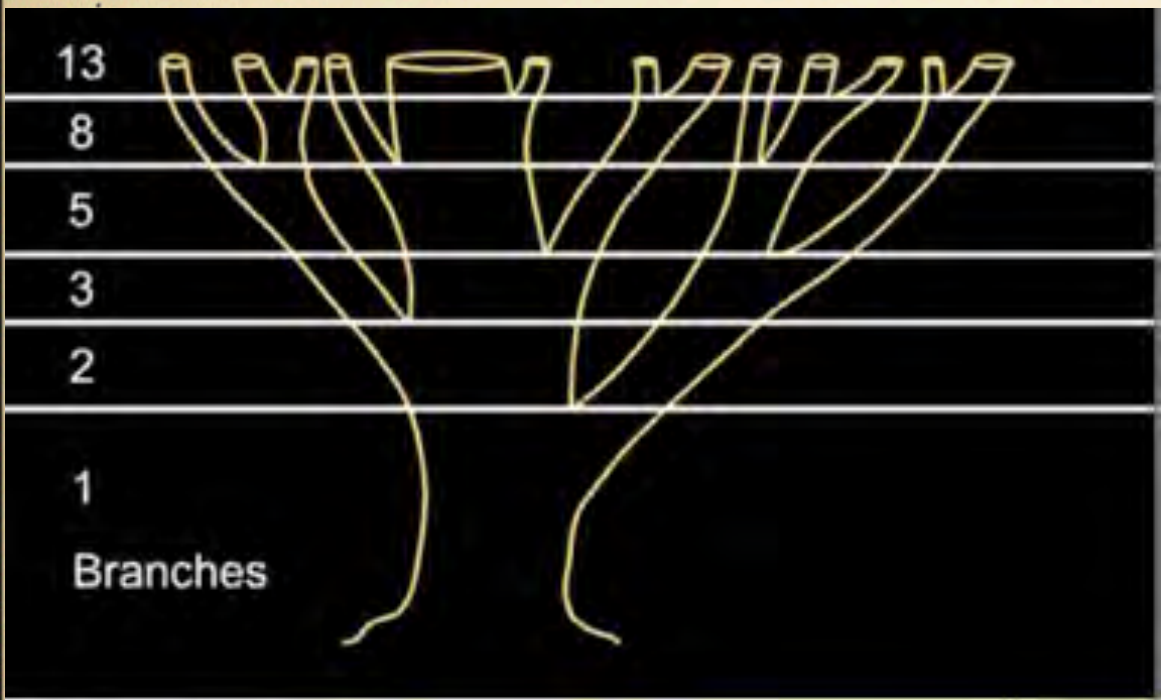
(Figure 3: Fibonacci Numbers and Petals of Flowers)

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89



55?
14

The Fibonacci Sequence in Nature- Trees & Bees



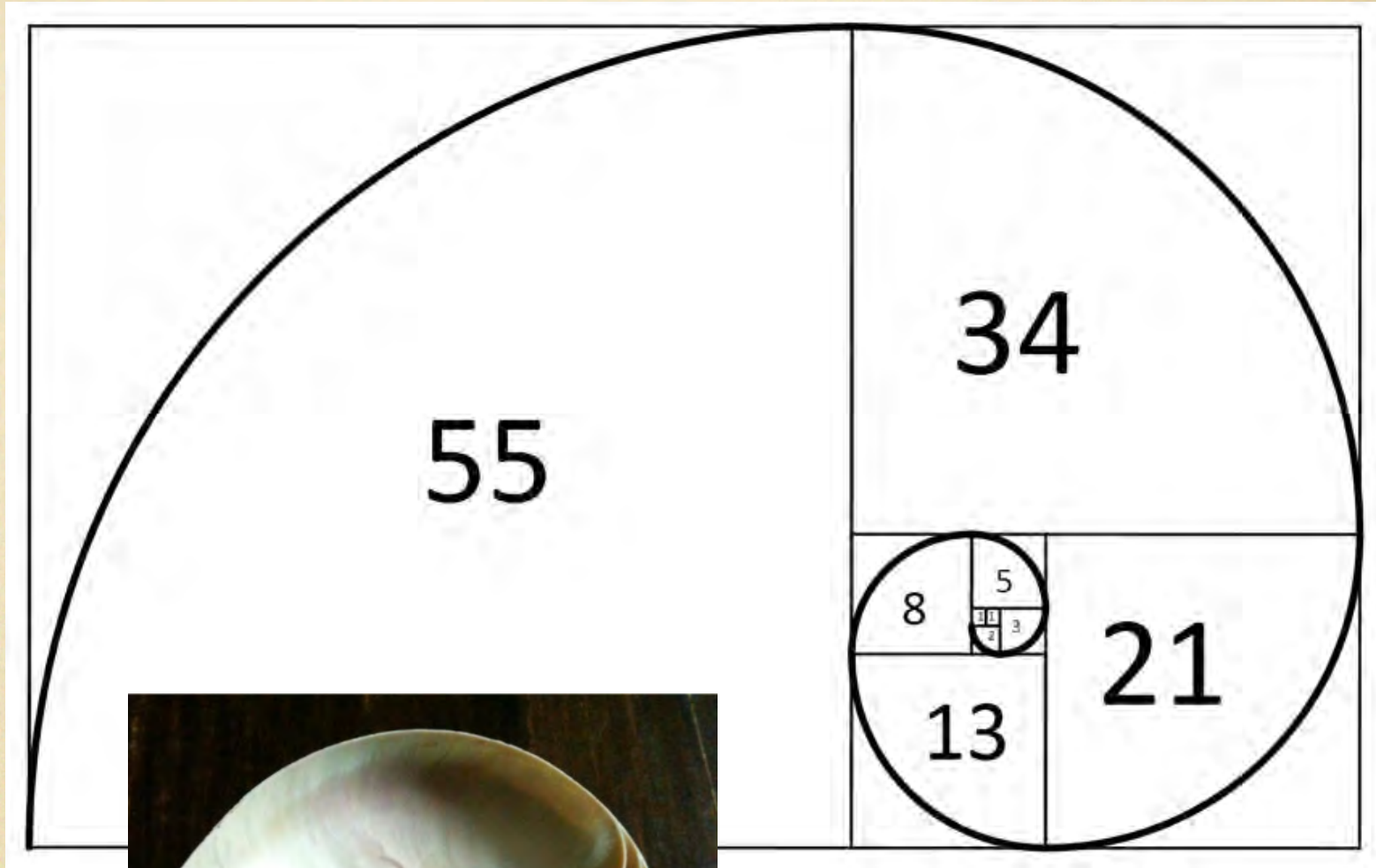
Female Bees can produce with or without a male!

Funfertilized → Male

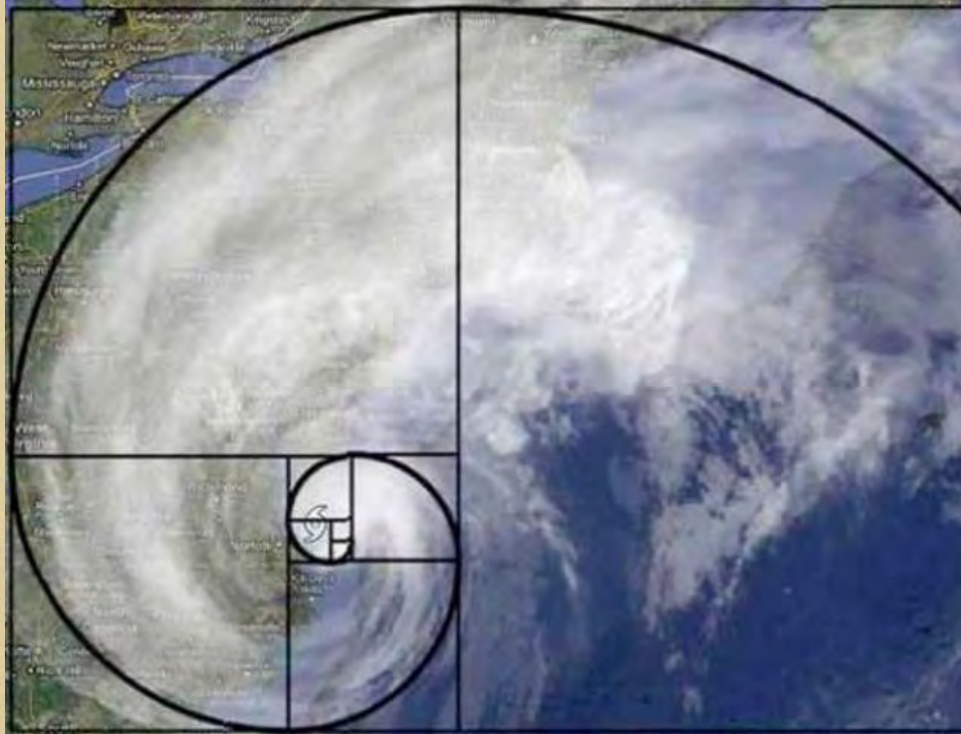
Ffertilized by male → Female



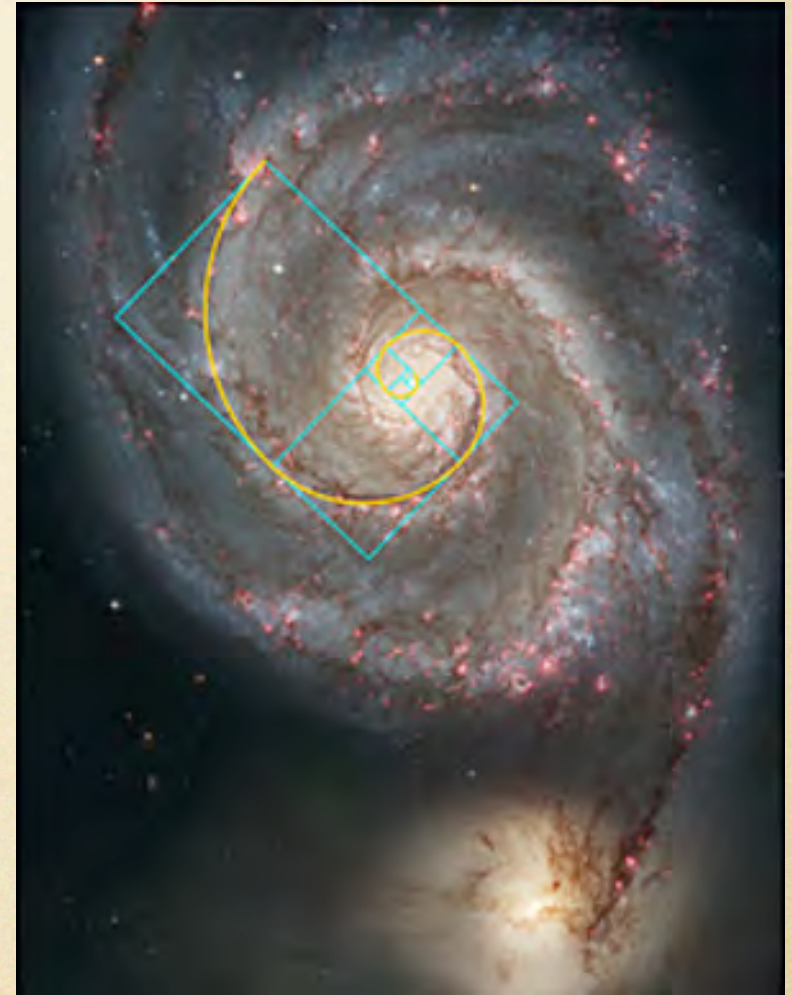
The Fibonacci Sequence/Spiral in Nature- Shells



The Fibonacci Spiral in Nature

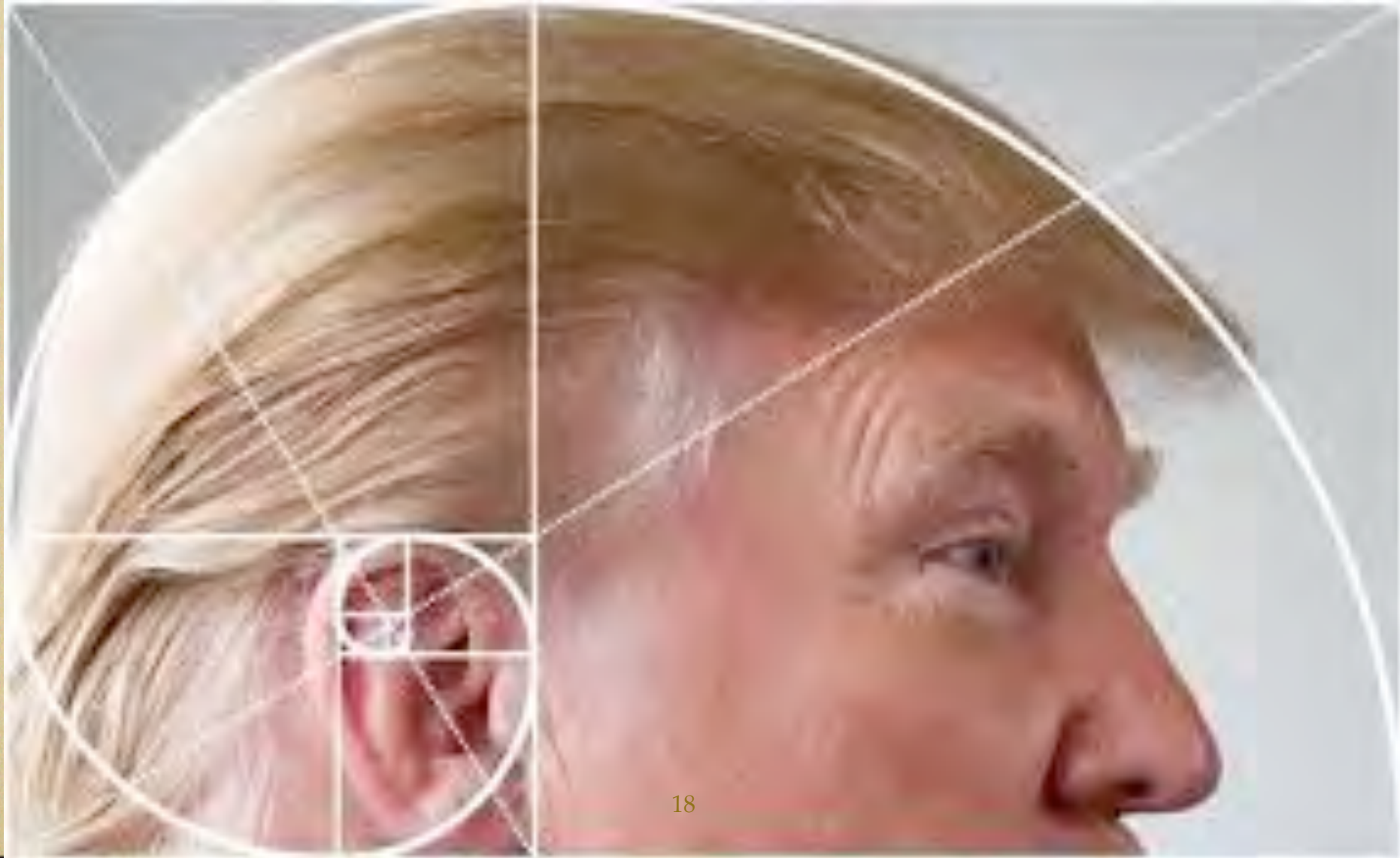


Aerial View of a
Hurricane



Telescopic View of a
Galaxy

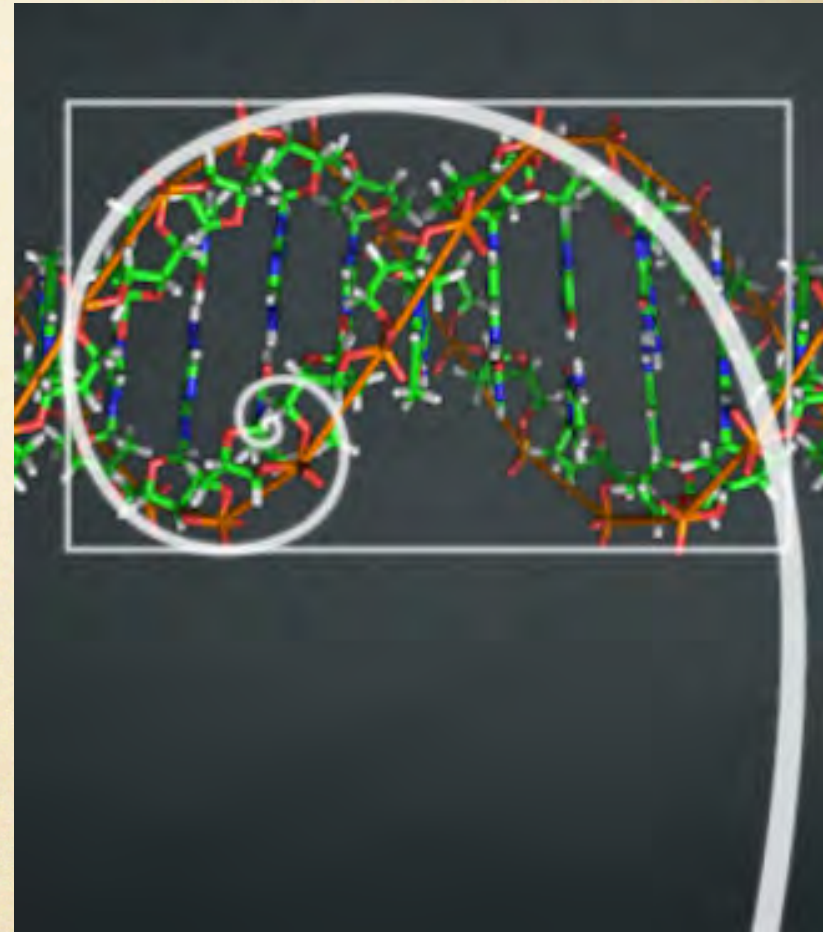
The Fibonacci Spiral in Nature- Where You Least Expect It!



The Fibonacci Spiral in Life /Living Things

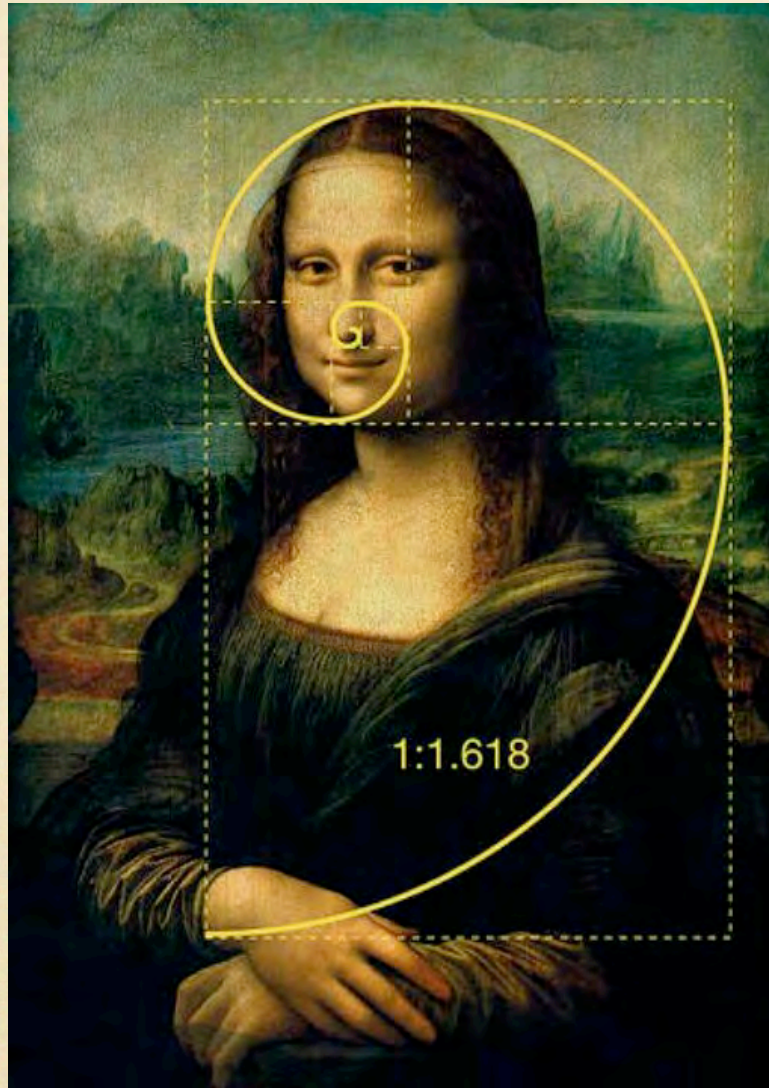


Proboscis of a
Sap-Feeding
Butterfly



Double Helix
DNA Spiral

The Fibonacci Spiral in Art



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

SOME BEAUTY FROM GEOMETRY

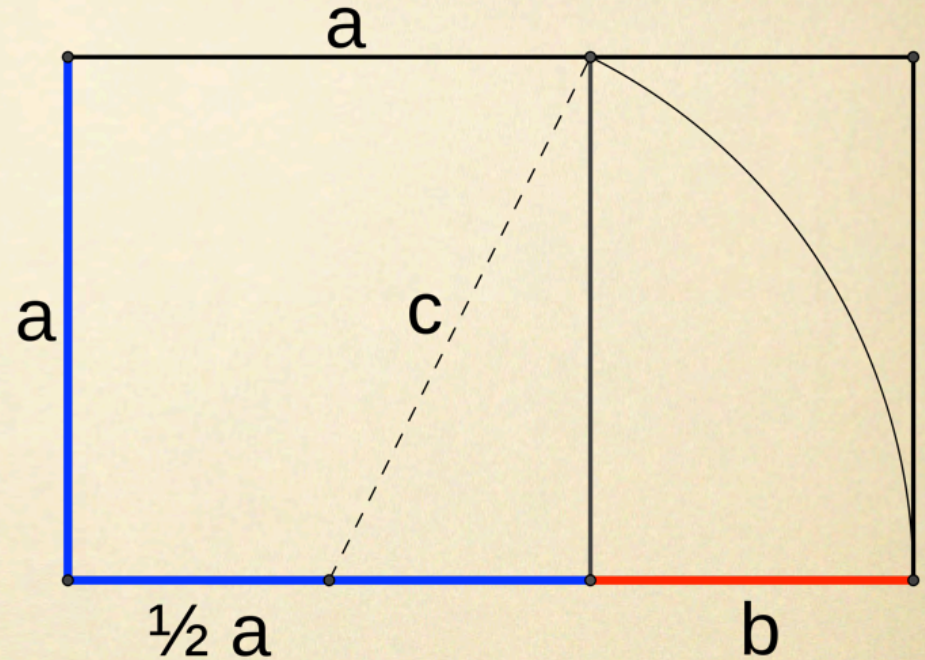
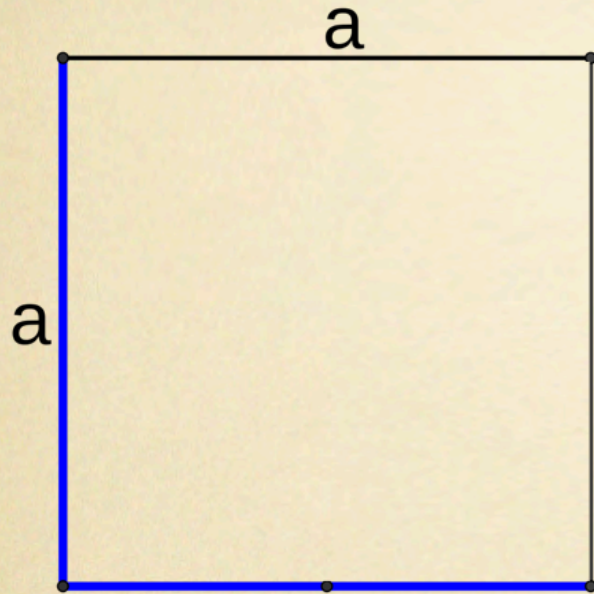
A **GOLDEN RECTANGLE** IS A SPECIAL, AESTHETICALLY PLEASING, RECTANGLE IN WHICH THE LENGTH L DIVIDED BY THE WIDTH W IS APPROXIMATELY 1.618.



$$L / W = \Phi \approx 1.618 \quad (\text{Golden ratio})$$

Phi

CONSTRUCTING A GOLDEN RECTANGLE



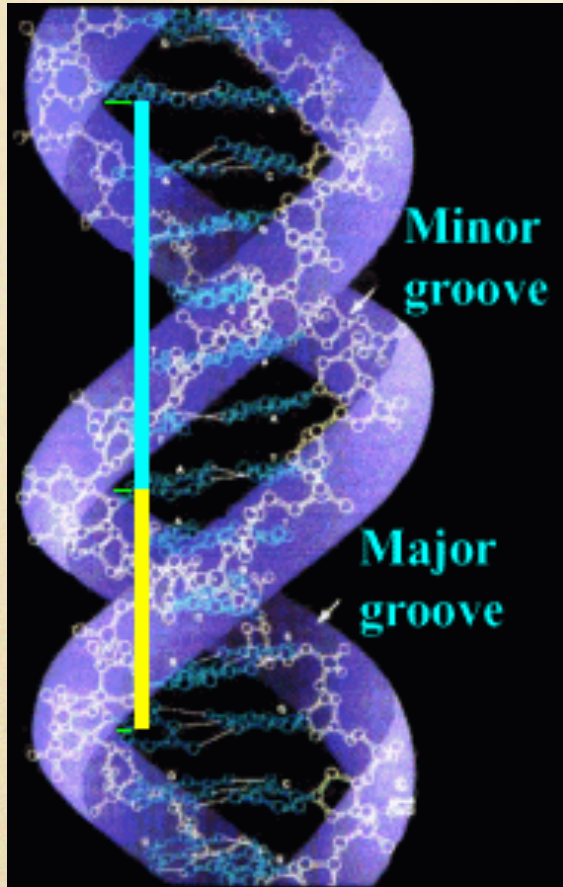
$$c^2 = (a/2)^2 + a^2 = 5a^2/4 \quad c = (\sqrt{5} a)/2$$

$$\text{Length} = a/2 + (\sqrt{5} a)/2 = a(\sqrt{5} + 1)/2 \approx 1.618a$$

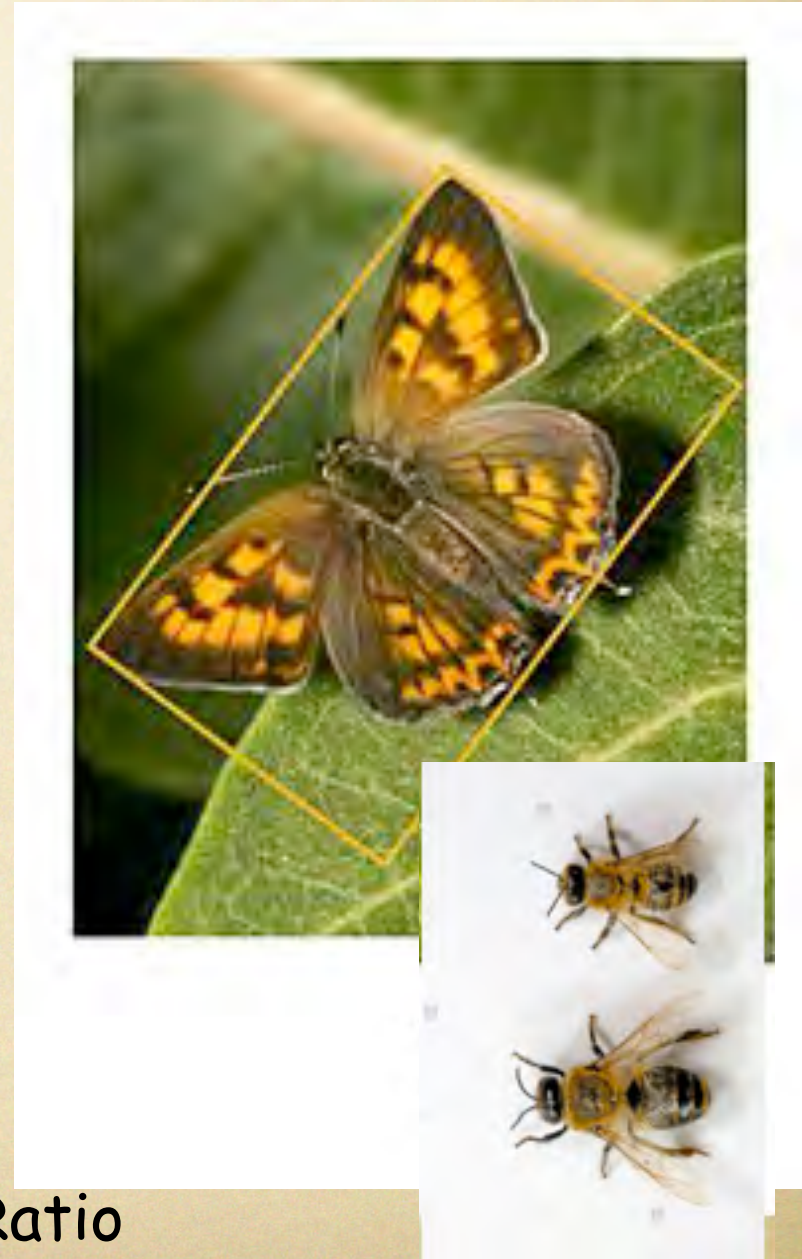
$$\text{Length} / \text{Width} = 1.618a/a \approx 1.618$$

= Golden Ratio

The GOLDEN RATIO IN LIFE

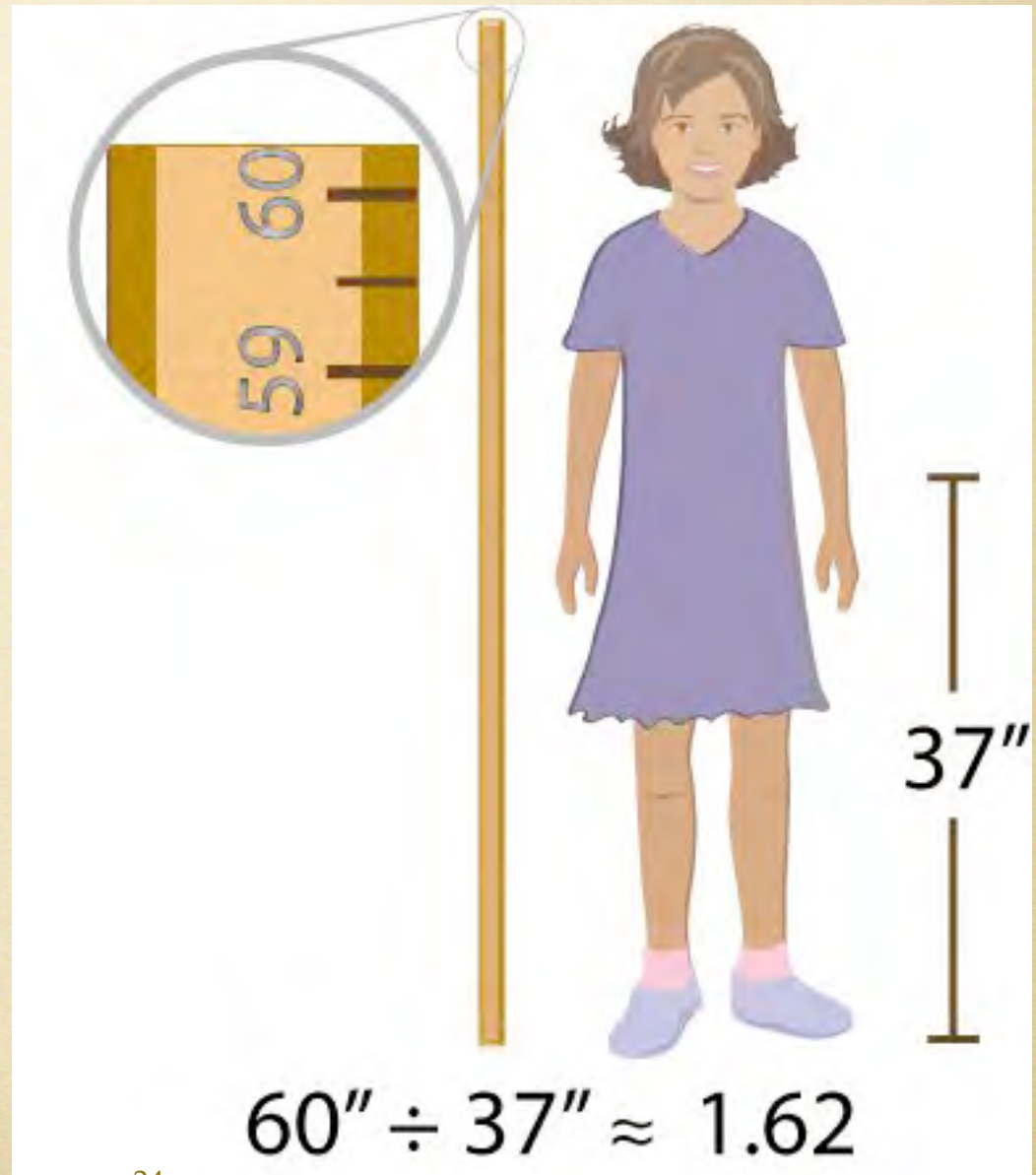


The ratio of the Major groove to the Minor groove in the DNA Double Helix Spiral is the Golden Ratio



THE GOLDEN RATIO IN THE HUMAN BODY

HEIGHT/
HEIGHT OF
NAVEL



“Beauty is in the Phi of the beholder.”



Florence Colgate, England²⁵

Height of head/Width of Head

Eyes to lip center/Lips to Chin

Nose to Chin/Lips to Chin

Bottom of Nose to Top of
Lips/Top of lips to bottom
of lips

The above, and at least 16
others. All are the Golden
Ratio (Phi) ≈ 1.618



More About "God's Fingerprint" in the Human Body

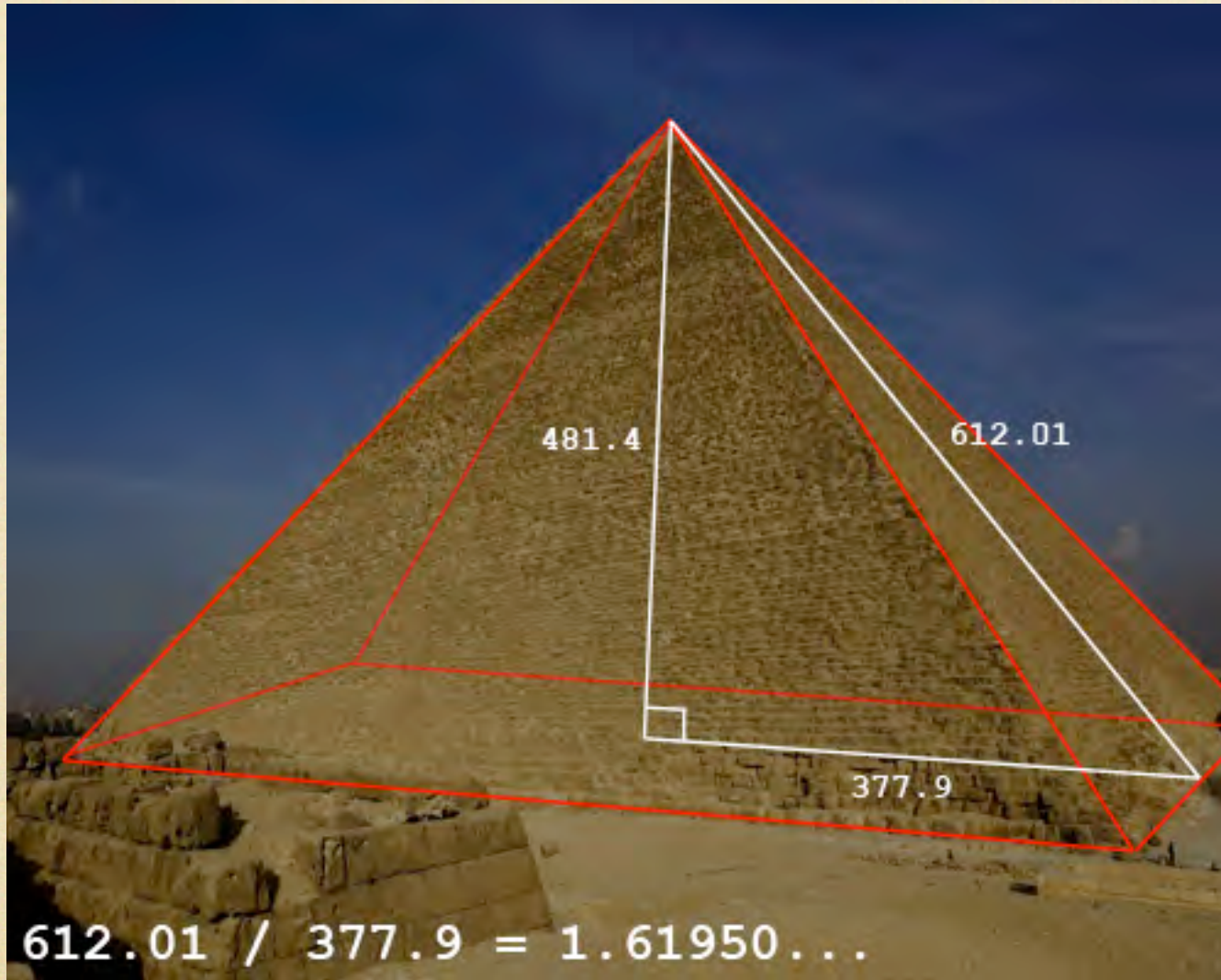
From measurement of 5000 Uteruses per year by ultrasound, Dr Jasper Verguts, a Gynecological Specialist at the University Hospital Lueven in Belgium looked at the ratio of uterus length to width (uterus ratio) and found:

For newborn girls, the uterus ratio is about 2

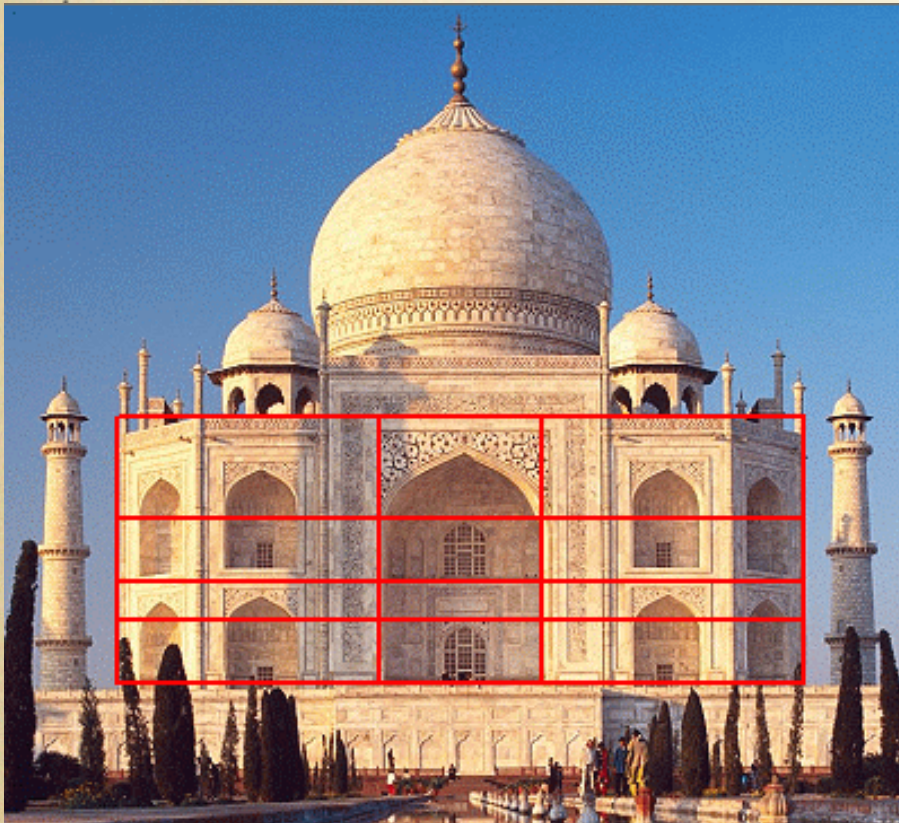
In old age, the uterus ratio shrinks to 1.46

In the most fertile time of a woman's life (Between ages 16 and 20) the uterus ratio is 1.6, strikingly close to the Golden Ratio!

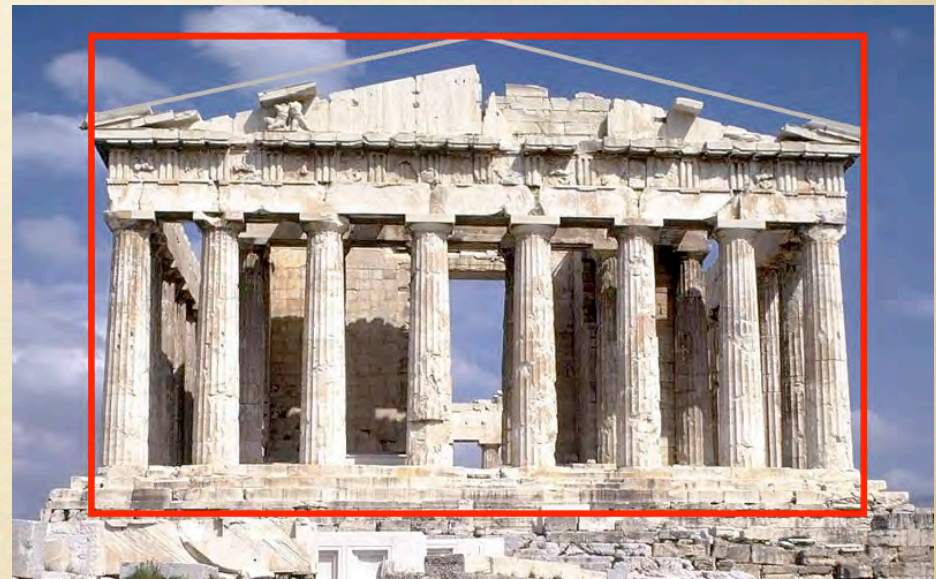
THE GOLDEN RATIO IN THE GREAT PYRAMID



THE GOLDEN RATIO IN ANCIENT BUILDINGS



The Taj Mahal, India



The Parthenon, Greece

THE GOLDEN RATIO IN MODERN BUILDINGS



The CN Building in Toronto. The ratio of its height (553 m) to the height of its observation tower is 1.618



The UN Building in NYC. It's width compared to the height of every 10 floors is 1.618

THE GOLDEN RATIO IN VIOLIN CONSTRUCTION

$$\frac{a1 + a2}{a2} = \frac{a2}{a1} = \frac{b2}{b1} = \frac{b2}{c2} = \frac{c2}{c1} = \phi$$

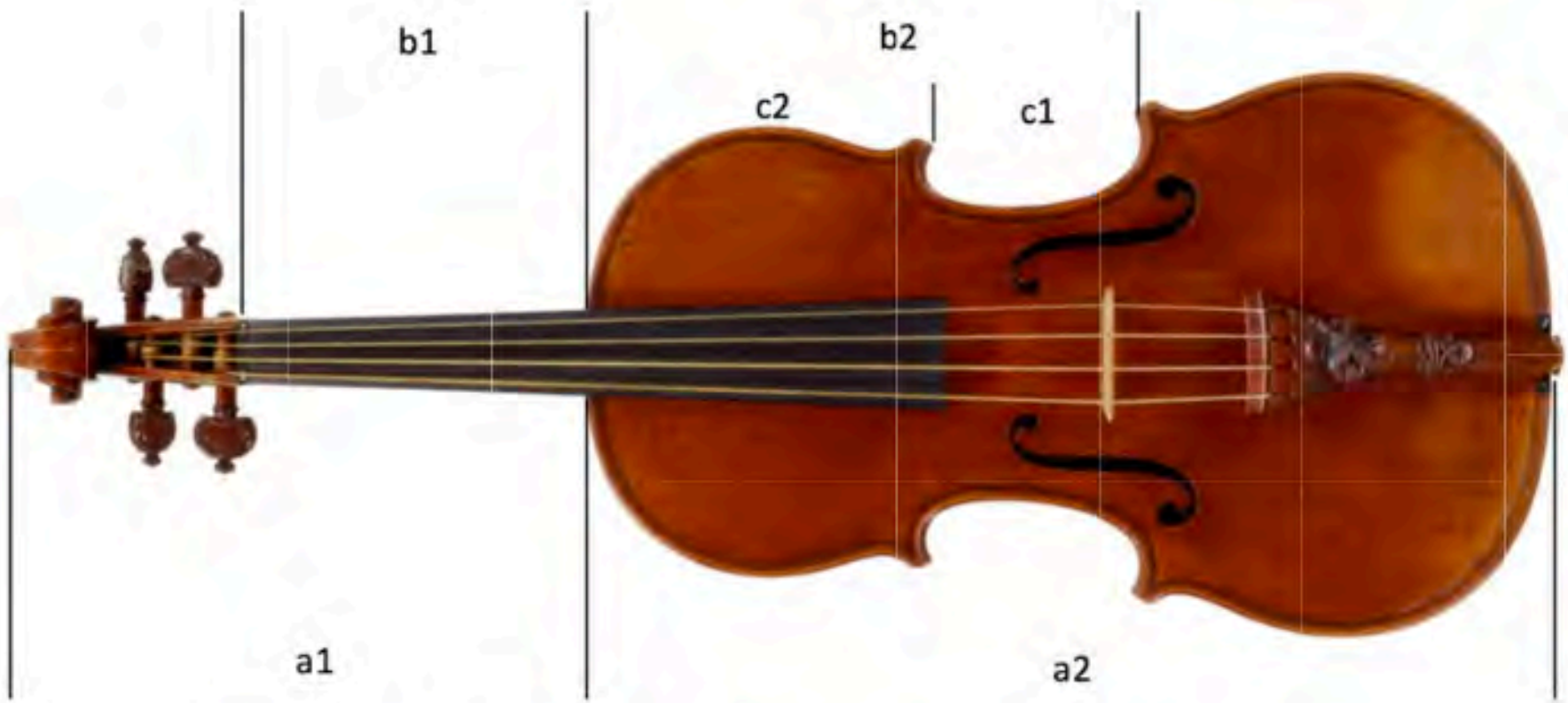


Figure 2. Photo of "Lady Blunt" Stradivarius violin (sold for nearly \$16M).

Applications in Music

It is clear that the Fibonacci sequence of numbers and the golden ratio are manifested in music. The numbers are present in the octave, the foundational unit of melody and harmony. Stradivarius used the golden ratio to make the greatest string instruments ever created. Roy Howat's research on Debussy's works shows that the composer used the golden ratio and Fibonacci numbers to structure his music.

PURSuing THE BEAUTY FURTHER- AN AMAZING RELATIONSHIP!

The Golden Ratio is
"Married to" the
Fibonacci Sequence!

1 , 1 , 2 , 3 , 5 , 8 , 13 , 21 , 34 →

A term of the Fibonacci Sequence,
say 21, divided by the term before
it, 13, is the Golden Ratio,
approx 1.618, as it's limiting value.

$$1/1 = 1.000000$$

$$2/1 = 2.000000$$

$$3/2 = 1.500000$$

$$5/3 = 1.666666$$

$$8/5 = 1.600000$$

$$13/8 = 1.625000$$

$$21/13 = 1.615385$$

$$34/21 = 1.619048$$

$$55/34 = 1.617647$$

$$89/55 = 1.618182$$

$$144/89 = 1.617978$$

$$233/144 = 1.618056$$

SOME BEAUTY FROM TOPOLOGY

Topology is the area of mathematics dealing with properties of space that are preserved under continuous deformations, such as stretching, crumpling, and bending, but not tearing or gluing.



SOME BEAUTY FROM TOPOLOGY

IS IT POSSIBLE TO TAKE OFF YOUR VEST
WITHOUT TAKING OFF YOUR COAT?



TOPOLOGISTS KNOW!



Nature is written
in mathematical language.

Galileo Galilei

MATHEMATICS, RIGHTLY
VIEWED, POSSESSES NOT
ONLY TRUTH, BUT
SUPREME BEAUTY.

- BERTRAND RUSSELL



MATHEMATICS IS THE
MOST BEAUTIFUL
AND MOST
POWERFUL
CREATION OF THE
HUMAN SPIRIT.

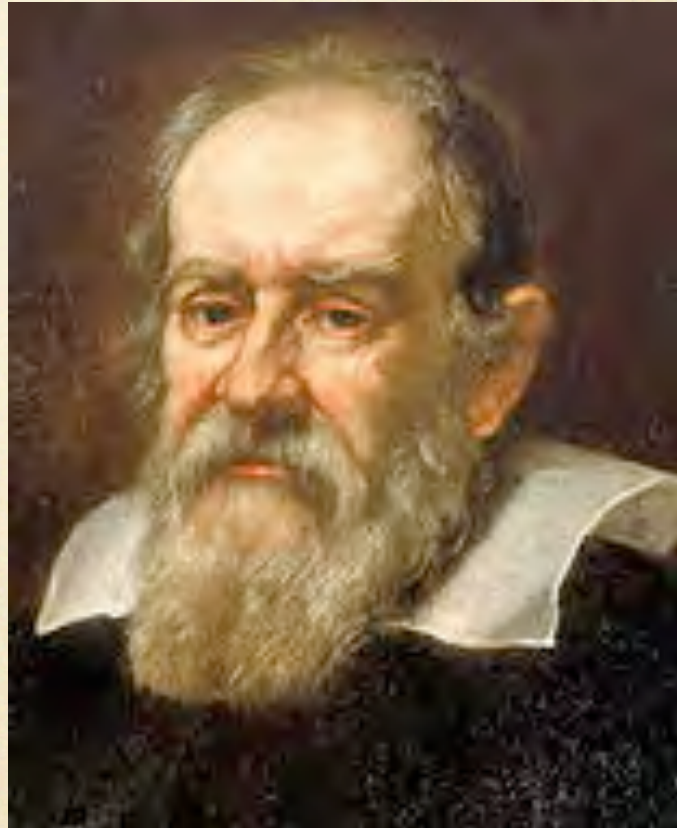
QUOTEHD.COM

Stefan Banach
Polish Mathematician

“Mathematics is the language in which God has written the universe”

“If I were again beginning my studies, I would follow the advice of Plato and start with mathematics”

Galileo Galilei



**THE MATHEMATICIAN'S
PATTERNS...
MUST BE BEAUTIFUL ...
BEAUTY IS THE FIRST TEST;
THERE IS NO PERMANENT
PLACE IN THE WORLD FOR
UGLY MATHEMATICS.**

G. H. HARDY

$$1 \times 8 + 1 = 9$$

$$12 \times 8 + 2 = 98$$

$$123 \times 8 + 3 = 987$$

$$1234 \times 8 + 4 = 9876$$

$$12345 \times 8 + 5 = 98765$$

$$123456 \times 8 + 6 = 987654$$

$$1234567 \times 8 + 7 = 9876543$$

$$12345678 \times 8 + 8 = 98765432$$

$$123456789 \times 8 + 9 = 987654321$$

Mathematics of Life

$$\text{Life} + \cancel{\text{Love}} = \text{Happy}$$

$$\text{Life} - \cancel{\text{Love}} = \text{Sad}$$

$$2 \text{ Life} = \text{Happy} + \text{Sad}$$

$$\therefore \text{Life} = \frac{\text{Happy} + \text{Sad}}{2}$$

$$\therefore \text{Life} = \frac{1}{2} \text{ Happy} + \frac{1}{2} \text{ Sad}$$

That's Real Life. Enjoy It.

(x, why?)

Say, Cube, do you consider yourself to be religious?

I believe there are higher powers than us, if that's what you mean.



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