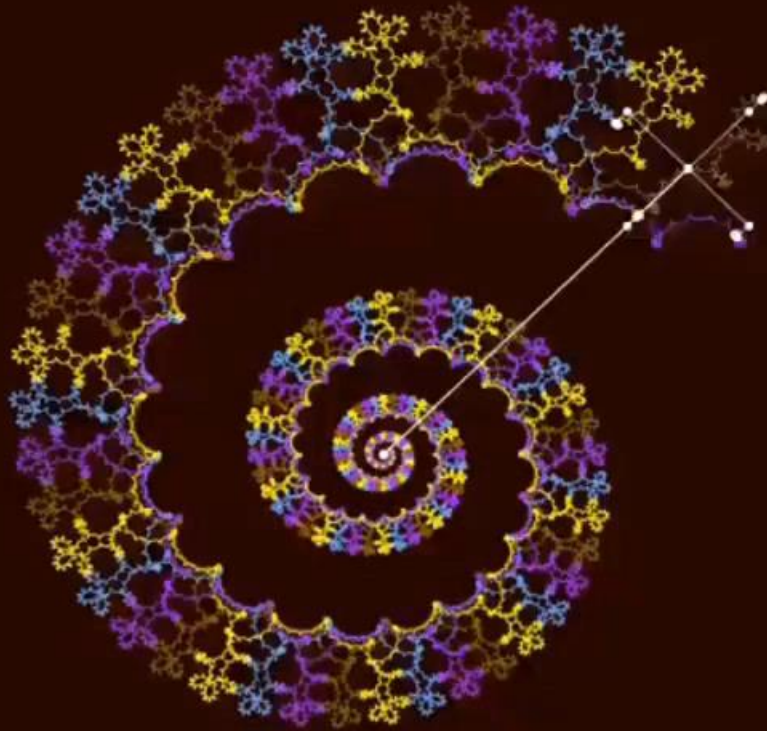


The Beauty of Mathematics – Part 2

Chuck Webber, teacher

Greenhouse Community

June 15, 2023

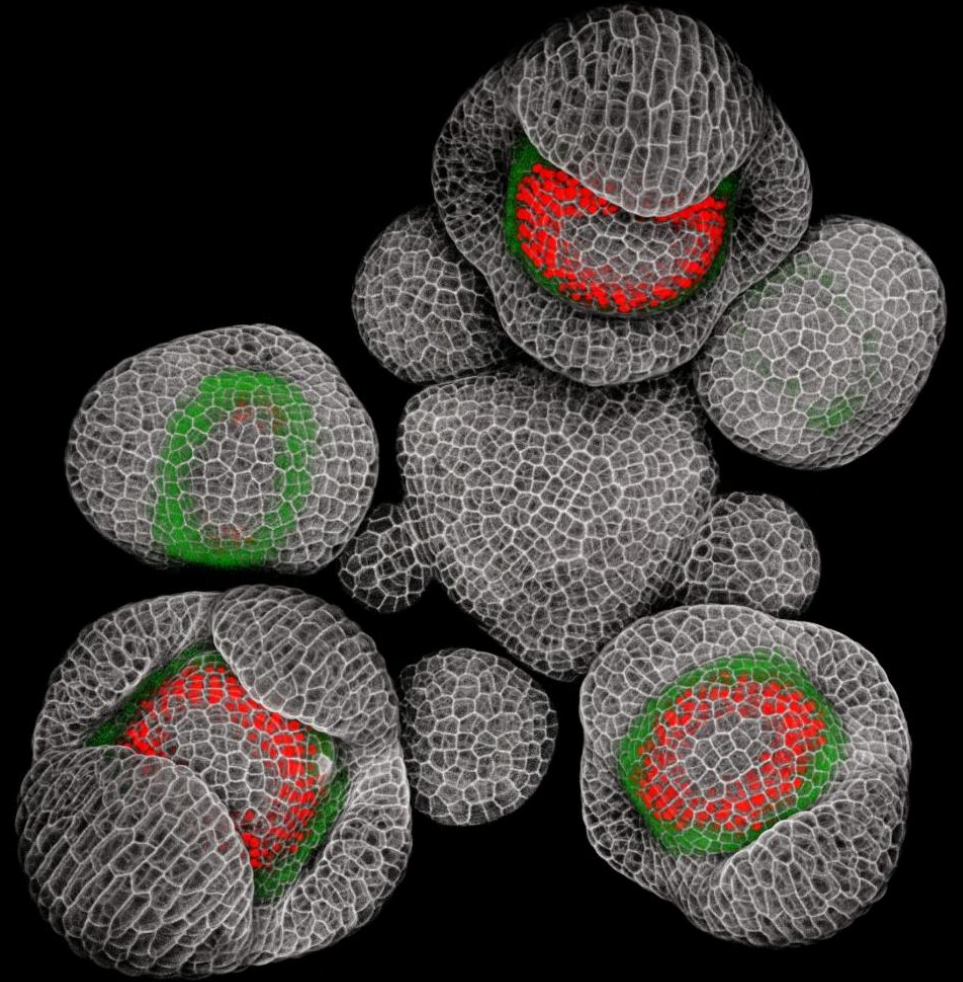


MATHEMATICS 1.01

1. LOGIC
2. TALLY COUNTS AND NUMBERS
3. ZERO VERSUS NOTHING
4. MEASUREMENTS AND CONSTANTS
5. PROBABILITY AND PREDICTION

MATHEMATICS 2.01

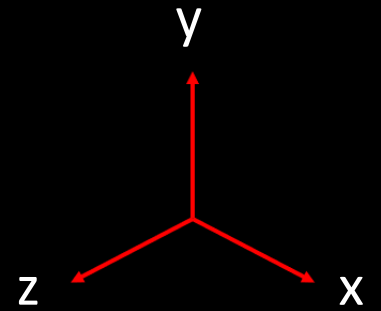
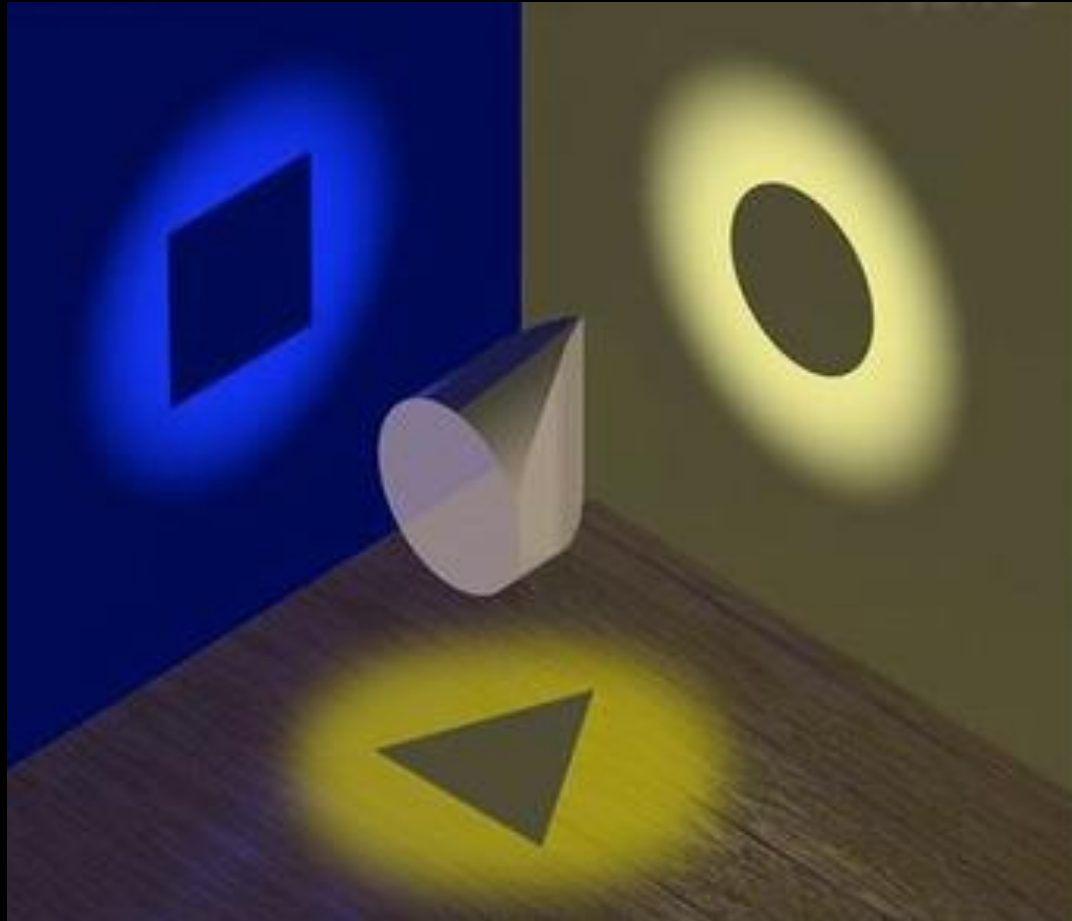
6. PERCEPTIONS, DIMENSIONS, AND SCALE
7. PATTERNS AND RECURRENCE
8. FRACTIONS AND FRACTALS
9. INFINITY AND ETERNITY



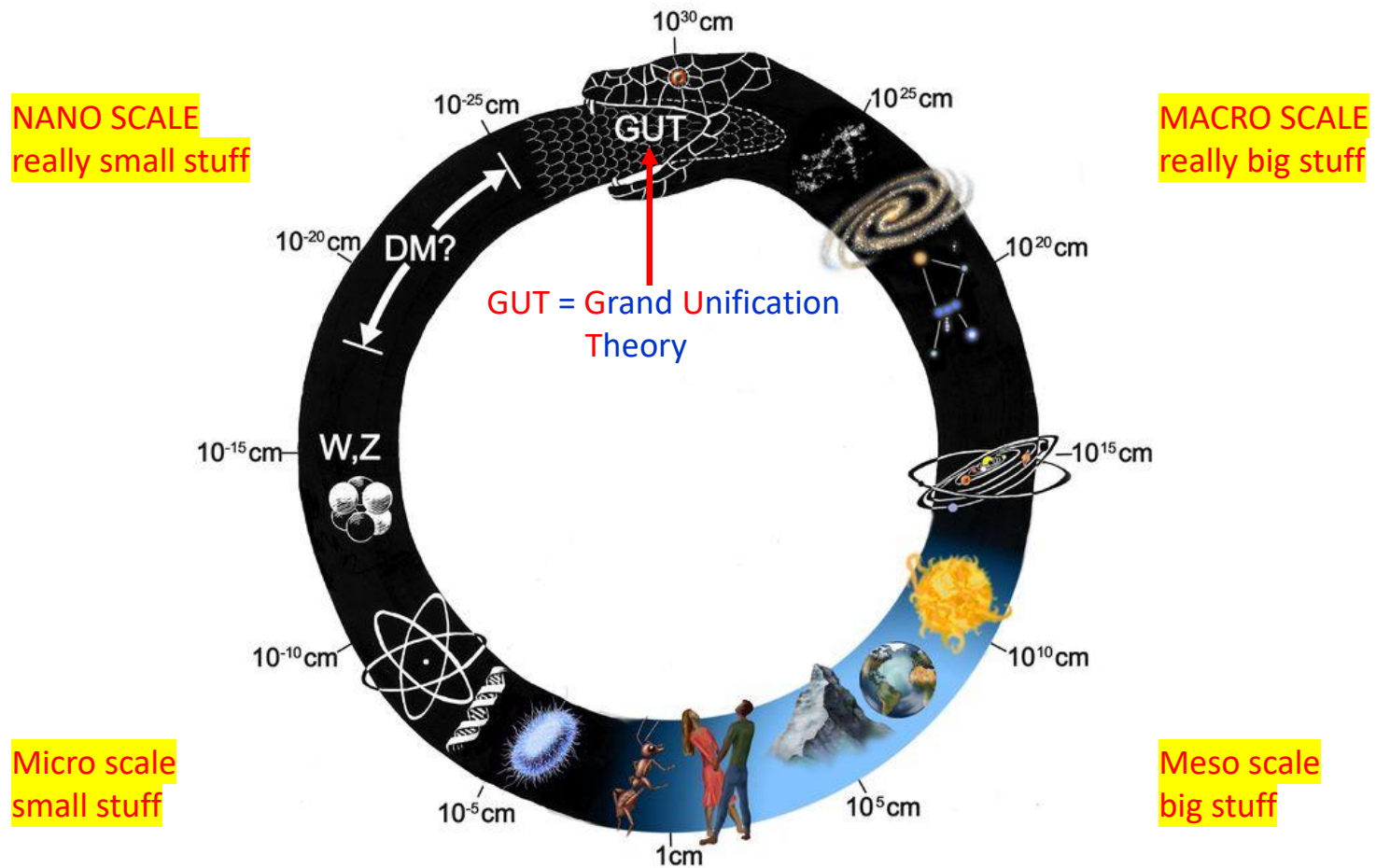
Young buds of the flowering plant Arabidopsis

6

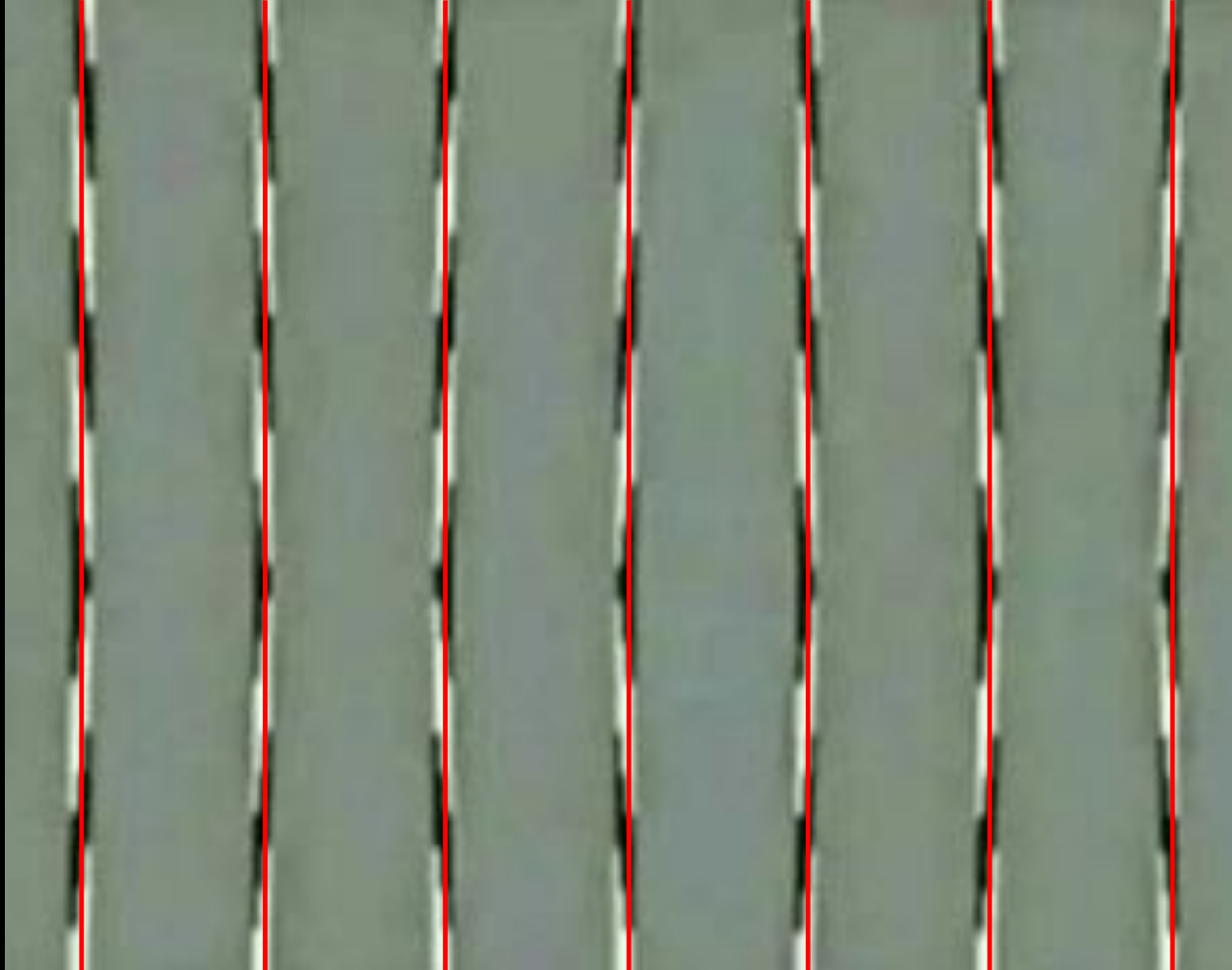
Perceptions, Dimensions and Scale



Mind-Blowing Range of Sizes within the Physical Universe



Are these 7 Straws Straight or Bent?



Size Perceptions of Grasshoppers, People, and God

³³ “And there we saw the Nephilim (the sons of Anak, who come from the Nephilim), and we seemed to ourselves like grasshoppers, and so we seemed to them.”
(Num. 13:33)

²¹ Do you not know? Do you not hear?
Has it not been told you from the beginning?
Have you not understood from the foundations of the earth?

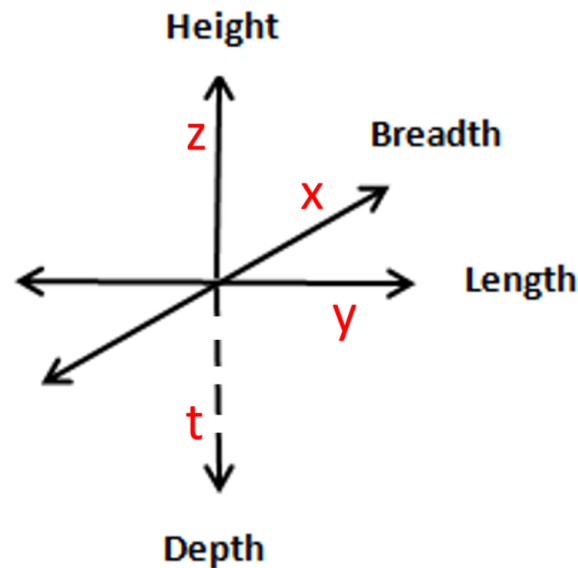
²² It is he who sits above the circle of the earth,
and its inhabitants are like grasshoppers;
who stretches out the heavens like a curtain,
and spreads them like a tent to dwell in;
(Isa. 40:21-22)



Four Dimensions of Love in Ephesians

¹⁷ so that Christ may dwell in your hearts through faith—that you, being rooted and grounded in love, ¹⁸ may have **strength to comprehend** with all the saints what is the breadth and length and height and depth, ¹⁹ and to know the love of Christ that surpasses knowledge, that you may be filled with all the fullness of God.

(Eph. 3:17-19)





I can tell you that if you boil
the ocean of 10,000
research articles, you'll find
the happiest people, they
pursue four things every
day: faith family friendship
and work that serves others
In other words, love love
love And more love

Arthur Brooks

Seven Dimensions of the Book of Revelation

Prologue: Rev. 1:1-8

Window 1: Rev. 1:9 – 3:22

Window 2: Rev. 4:1 – 7:17

Window 3: Rev. 8:1 – 11:18

Window 4: Rev. 11:19 – 15:4

Window 5: Rev. 15:5 – 19:10

Window 6: Rev. 19:11 – 21:8

Window 7: Rev. 21:9 – 22:9

Epilogue: Rev. 22:10-21

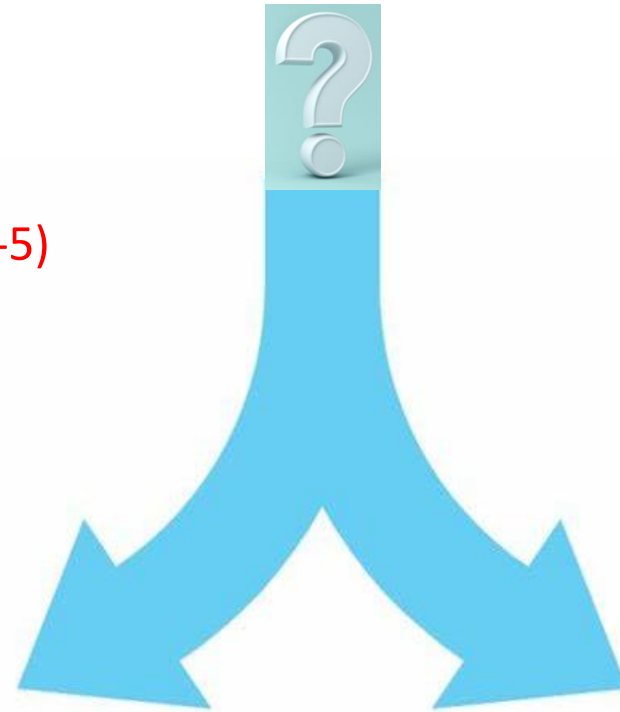
Answering a Fool Has Two Perspectives Demanding Discernment

⁴ Answer not a fool according to his folly,
lest you be like him yourself.

⁵ Answer a fool according to his folly,
lest he be wise in his own eyes.

(Prov. 26:4-5)

Do Not Answer
the Fool

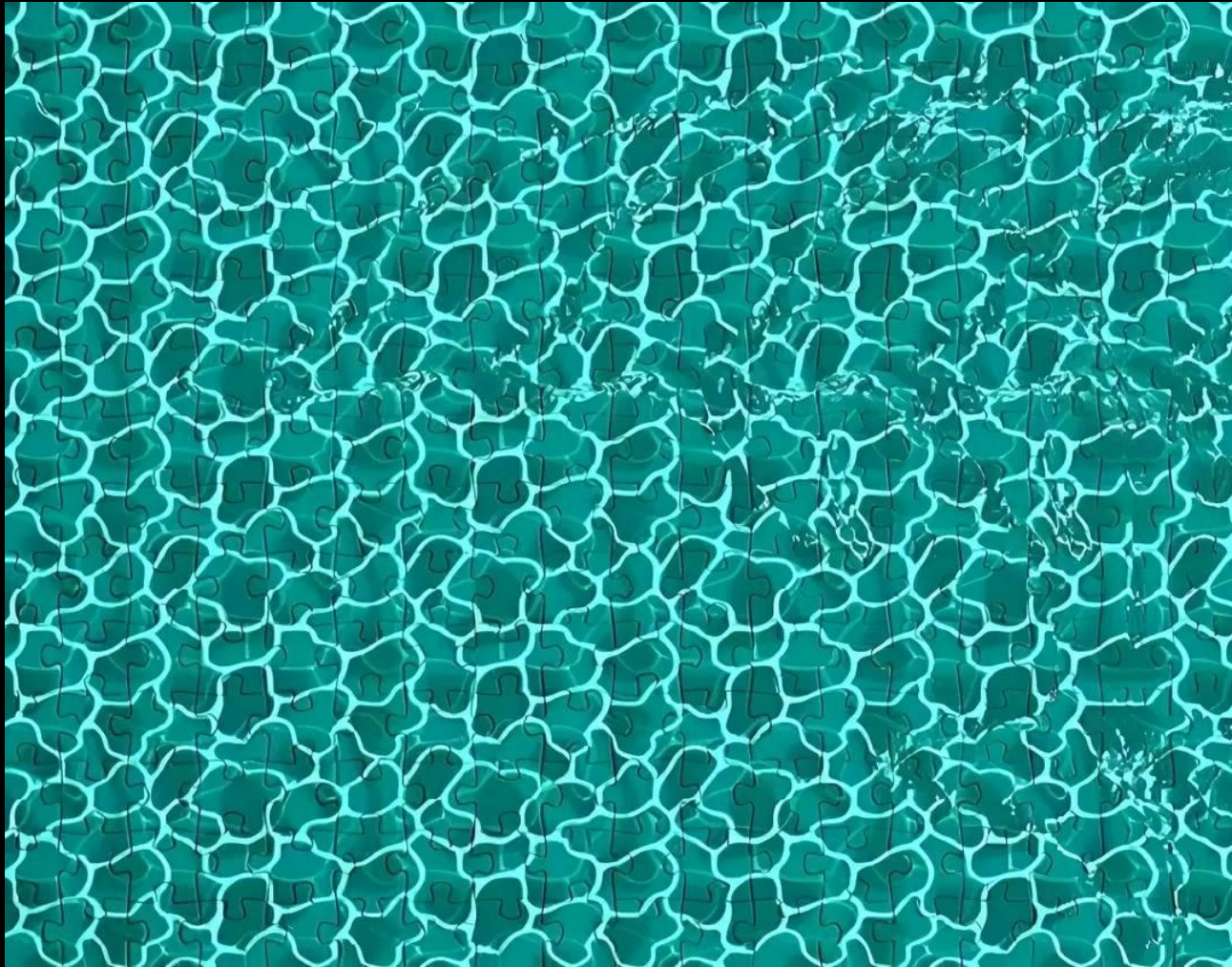


Do Answer
the Fool

11 He has made everything beautiful in its time. Also, he has put eternity into man's heart, yet so that he cannot find out what God has done from the beginning to the end. (**Eccl. 3:11**)



Name the sea creature in this 3-dimensional stereogram

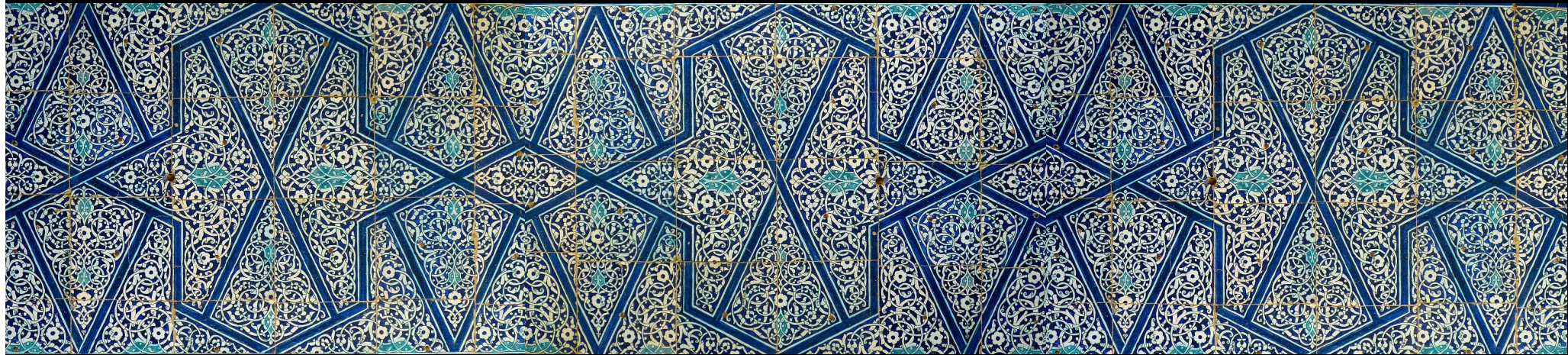


Why, its simply a friendly dolphin

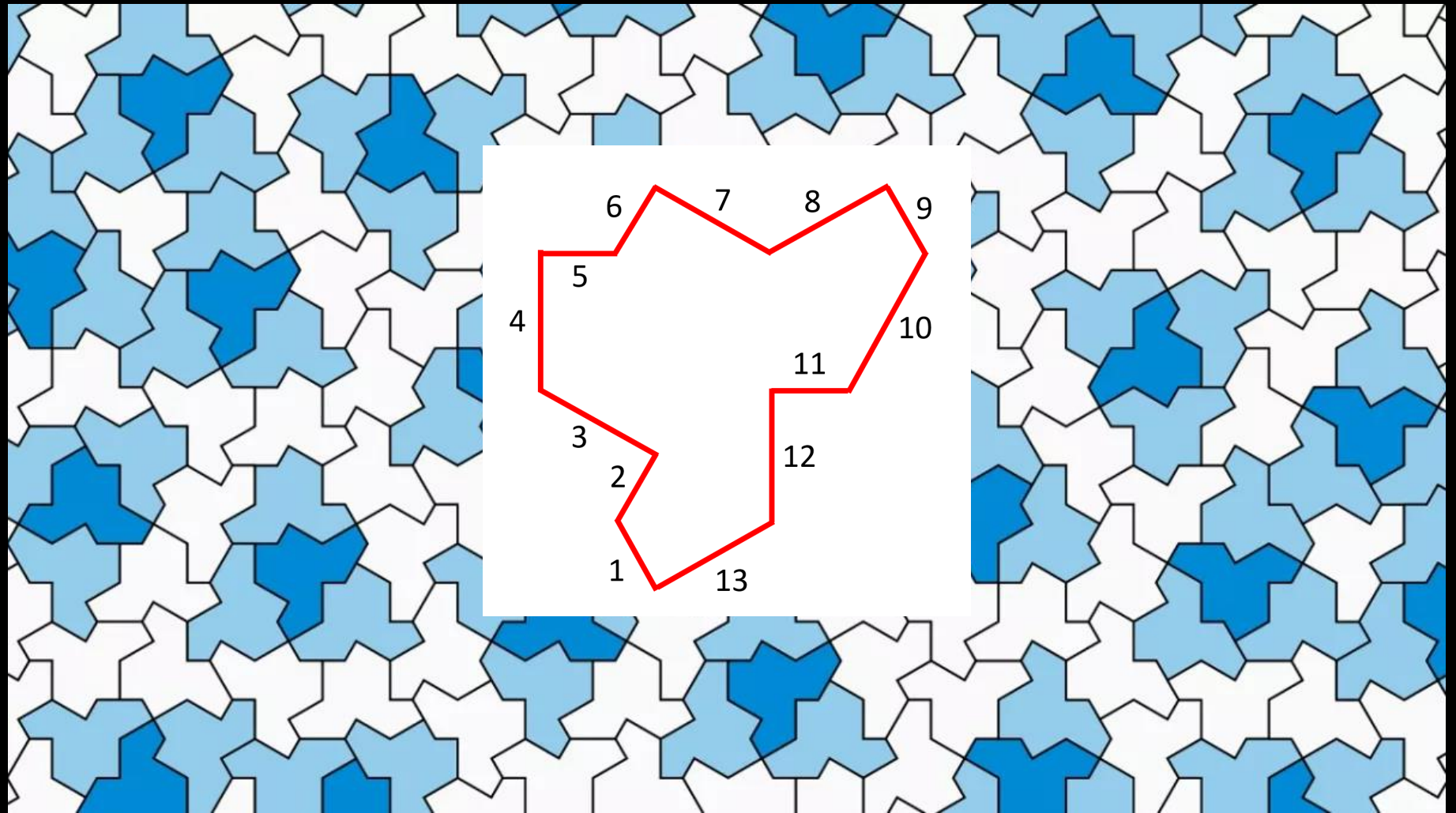


7

Patterns and Recurrence



Non-repeating Polygon Patterns Using the 13-sided "Einstein Tile"



Patterns and Schematics

⁸ And let them make me a sanctuary, that I may dwell in their midst. ⁹ Exactly as I show you concerning the pattern of the tabernacle, and of all its furniture, so you shall make it. (Ex. 25:8-9)

⁴ Now if he were on earth, he would not be a priest at all, since there are priests who offer gifts according to the law. ⁵ They serve a copy and shadow of the heavenly things. For when Moses was about to erect the tent, he was instructed by God, saying, “See that you make everything according to the pattern that was shown you on the mountain.” (Heb. 8:4-5)

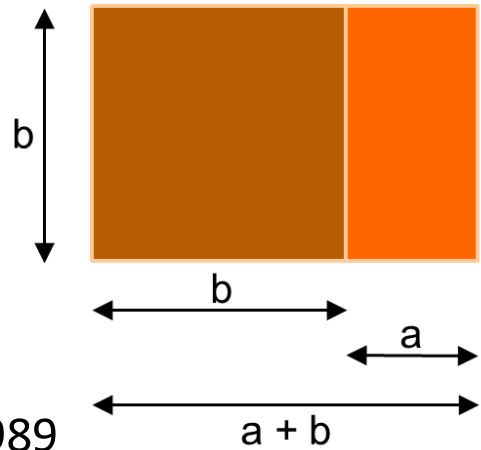
The Unending Fibonacci Sequence ($N_f = N_{f-1} + N_{f-2}$)

$N_f = 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377 \dots$

golden' rectangle:

$$\frac{b}{a} = \frac{a+b}{b}$$

golden ratio, ϕ
= 1.618033989



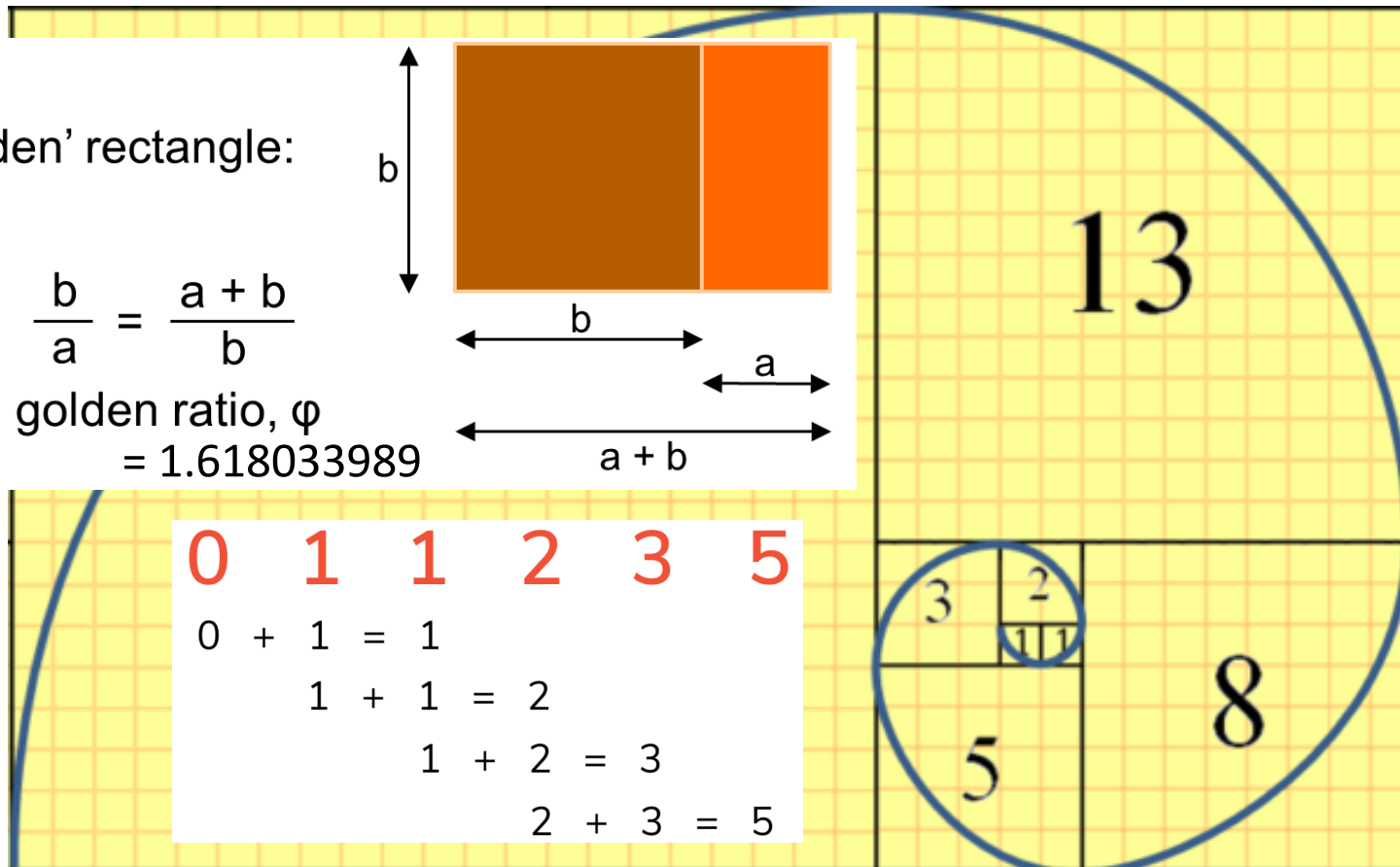
0 1 1 2 3 5

$$0 + 1 = 1$$

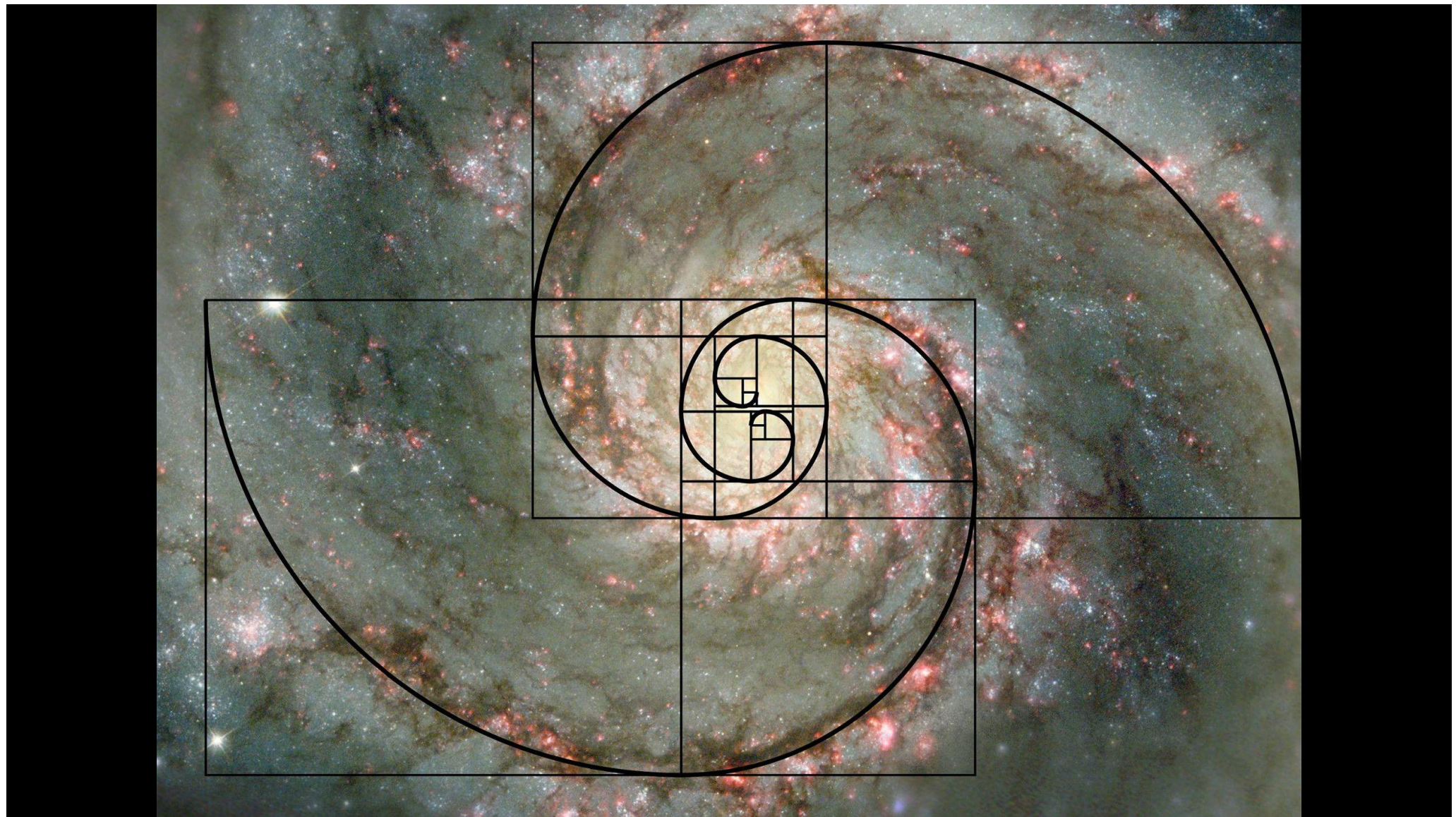
$$1 + 1 = 2$$

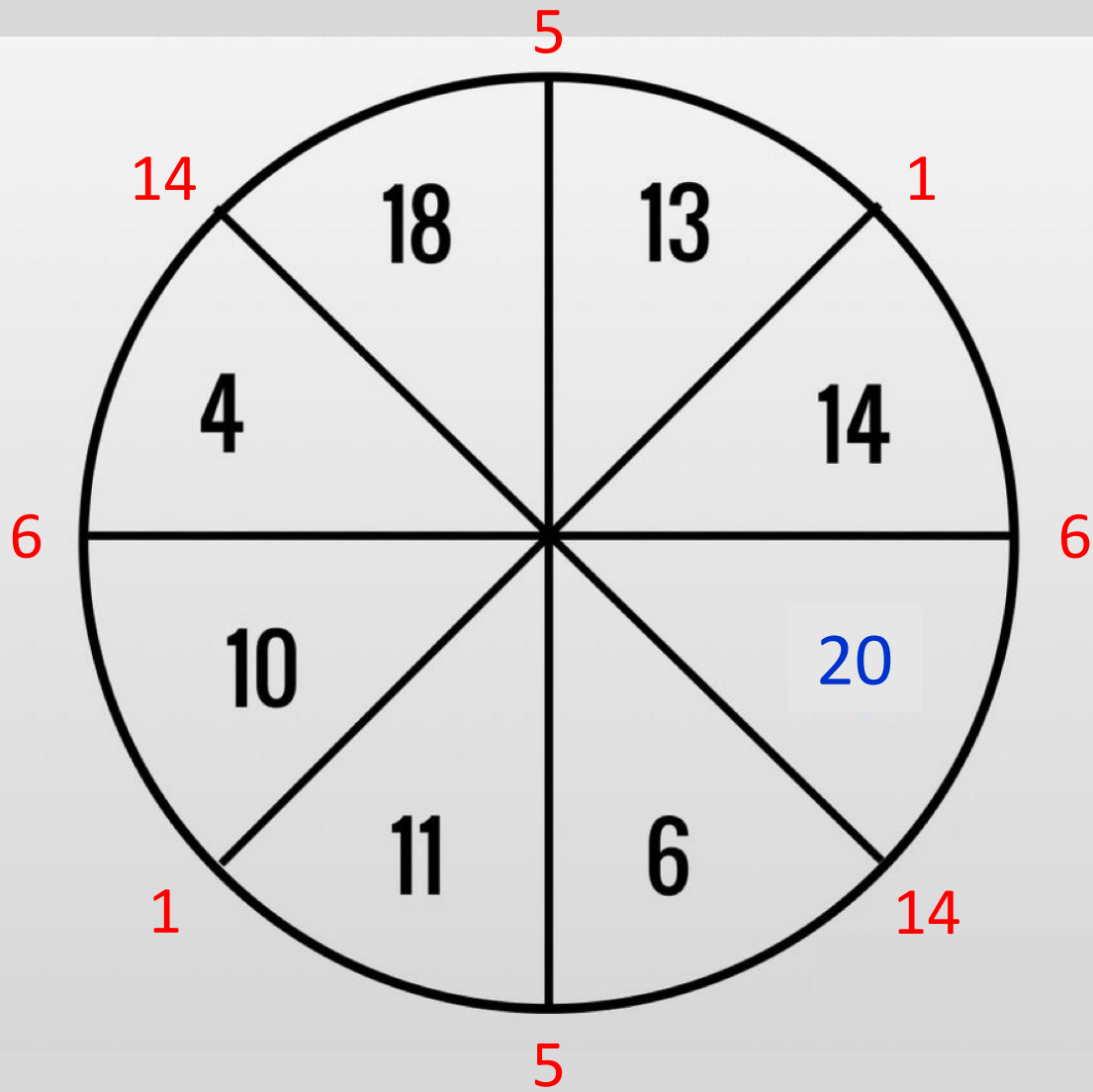
$$1 + 2 = 3$$

$$2 + 3 = 5$$



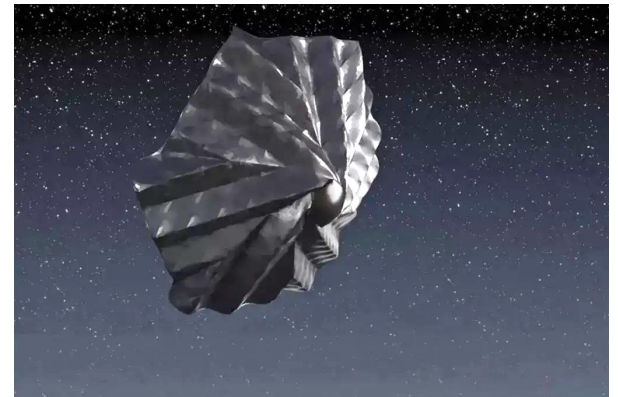






Fill in
the
missing
number

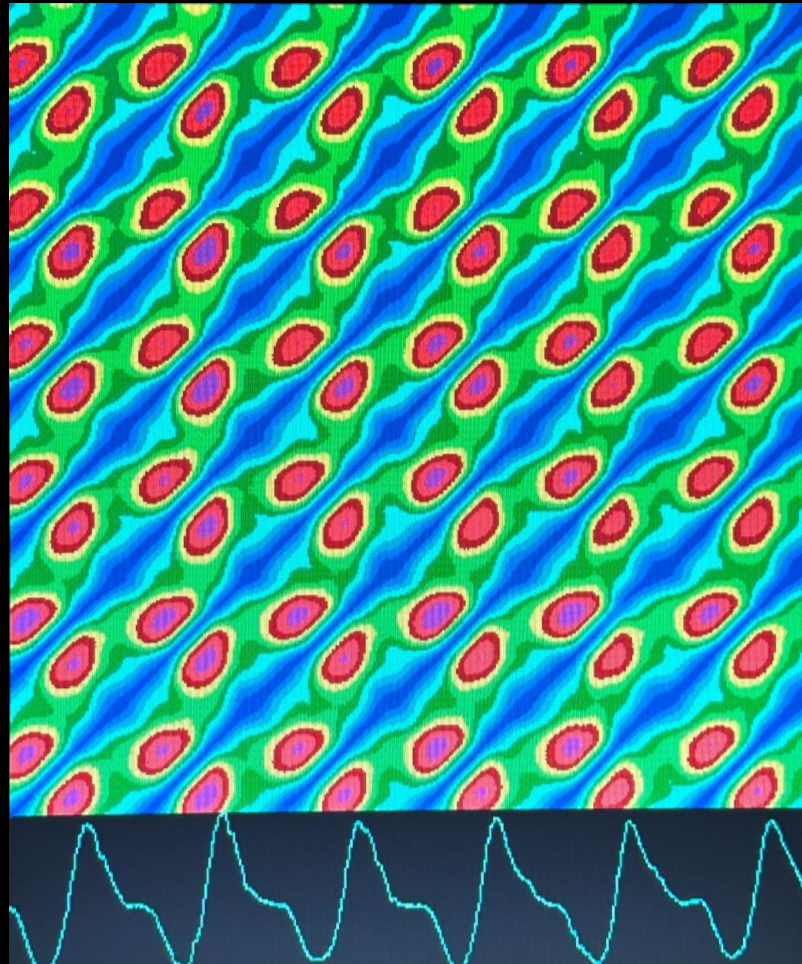
Folding Patterns in Nature Inspire Engineered Origami Structures



THEIR WINGS ARE **FLEXIBLE** ENOUGH TO
FOLD INTRICATELY, YET **STRONG ENOUGH**
TO FLY.



Recurrence Patterns or Return Maps



The **sun** recurs
(returns) every
morning, but at a
slightly different
position along
the horizon



January

February

March

April

May

June

July

August

September

October

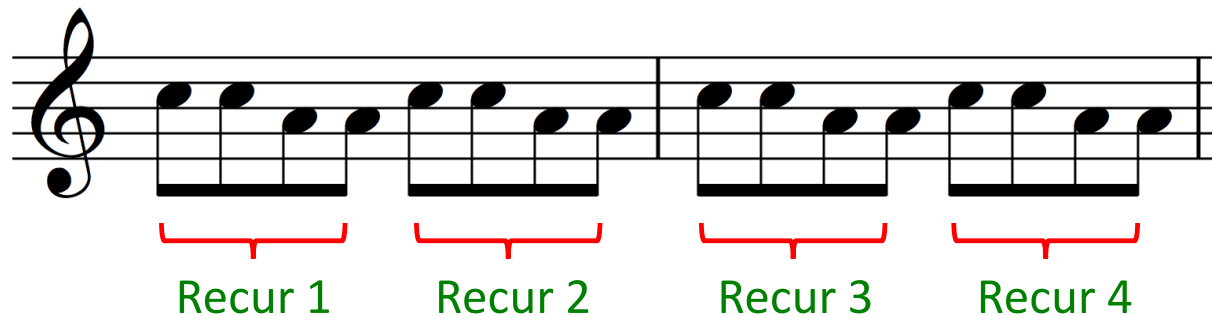
November

December

Exact Recurrences in Texts and Music

- ¹ Give thanks to the Lord, for he is good,
for his steadfast love endures forever. ← Recurrence 1
- ² Give thanks to the God of gods,
for his steadfast love endures forever. ← Recurrence 2
- ³ Give thanks to the Lord of lords,
for his steadfast love endures forever; ← Recurrence 3
- (Ps. 136:1-3)

Ostinato = an obstinate or persistent pattern that repeats constantly



Return to the Lord

³³ let the wicked forsake his way, and the unrighteous man his thoughts; let him return to the Lord, that he may have compassion on him, and to our God, for he will abundantly pardon. (Isa. 55:7)

⁷ The I will give them a heart to know that I am the Lord, and they shall be my people and I will be their God, for they shall return to me with their whole heart. (Jer. 24:7)

⁴⁰ Let us test and examine our ways,
and return to the Lord!

⁴¹ Let us lift up our hearts and hands
to God in heaven:

⁴² We have transgressed and rebelled,
and you have not forgiven.

(Lam. 3:40-42)

Return, Restore, Renew, Recur

¹² “Yet even now,” declares the Lord,
“return to me with all your heart,
with fasting, with weeping, and with mourning;
¹³ and rend your hearts and not your garments.”
Return to the Lord your God,
for he is gracious and merciful,
slow to anger, and abounding in steadfast love;
and he relents over disaster.

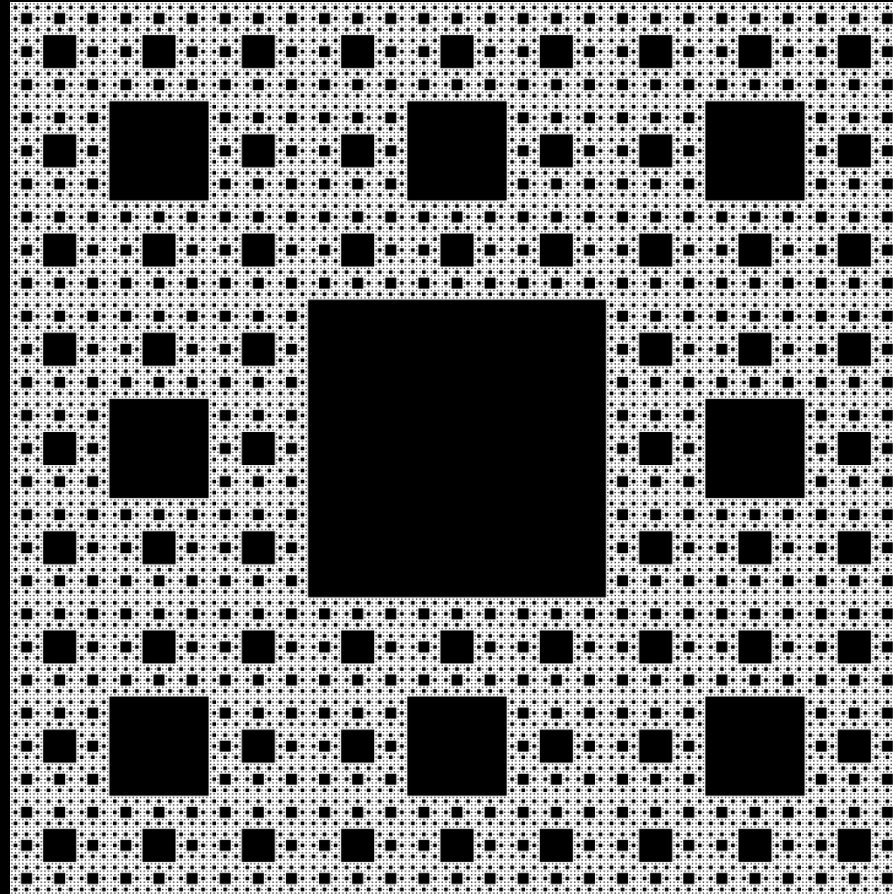
(Joel 2:12-13)

¹⁷ But when he came to himself, he said, “How many of my father's hired servants have more than enough bread, but I perish here with hunger! ¹⁸ I will arise and go [return] to my father, and I will say to him, ‘Father, I have sinned against heaven and before you. ¹⁹ I am no longer worthy to be called your son. Treat me as one of your hired servants.’”

(Luke 15:17-19)

8

Fractions and Fractals



²⁴ And the king said, “Bring me a sword.” So a sword was brought before the king. ²⁵ And the king said, “Divide the living child in two, and give half to the one and half to the other.” (1 Kings 3:24-25)



Zeno's Paradox (334 – 262 BCE)

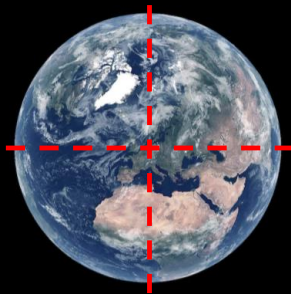
$$\text{Sum} = 1/2 + 1/4 + 1/8 + 1/16 + 1/32 + 1/64 + 1/128 + 1/256 + 1/512 + \dots = 0.9999999999999999 \dots$$



Fractions of Fractions (e.g. $1/3$ of $3/4 = 1/4$)

⁸ And I looked, and behold, a pale horse! And its rider's name was Death, and Hades followed him. And they were given authority over **a fourth** of the earth, to kill with sword and with famine and with pestilence and by wild beasts of the earth. (Rev. 6:8)

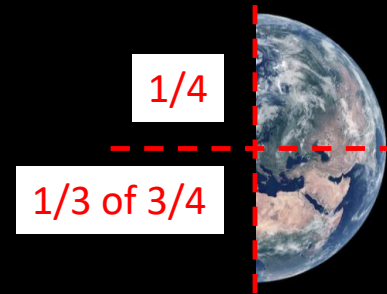
¹⁸ By these three plagues **a third** of mankind was killed, by the fire and smoke and sulfur coming out of their mouths. ¹⁹ For the power of the horses is in their mouths and in their tails, for their tails are like serpents with heads, and by means of them they wound. (Rev. 9:18)



100% alive



75% still alive



50% still alive

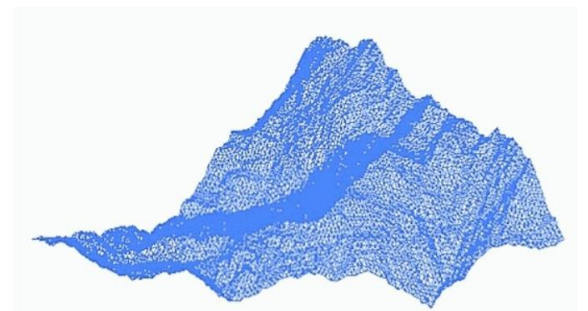
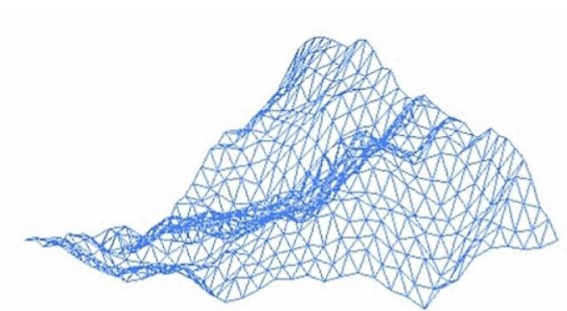
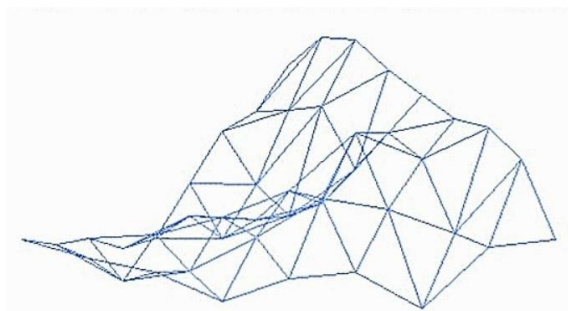
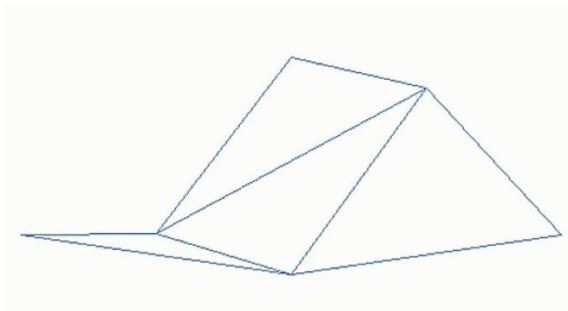
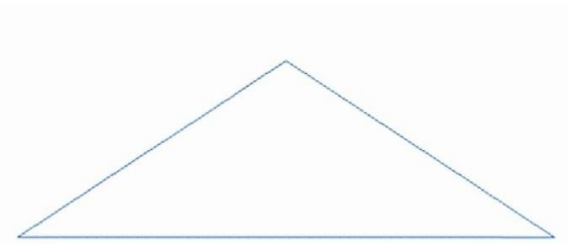
Question: How long is the coastline of Britain?

Answer: It depends upon the length (scale) of one's ruler

Observation: The shorter the ruler, the longer the measured coastline

Explanation: The coastline is not geometrical; it is fractal

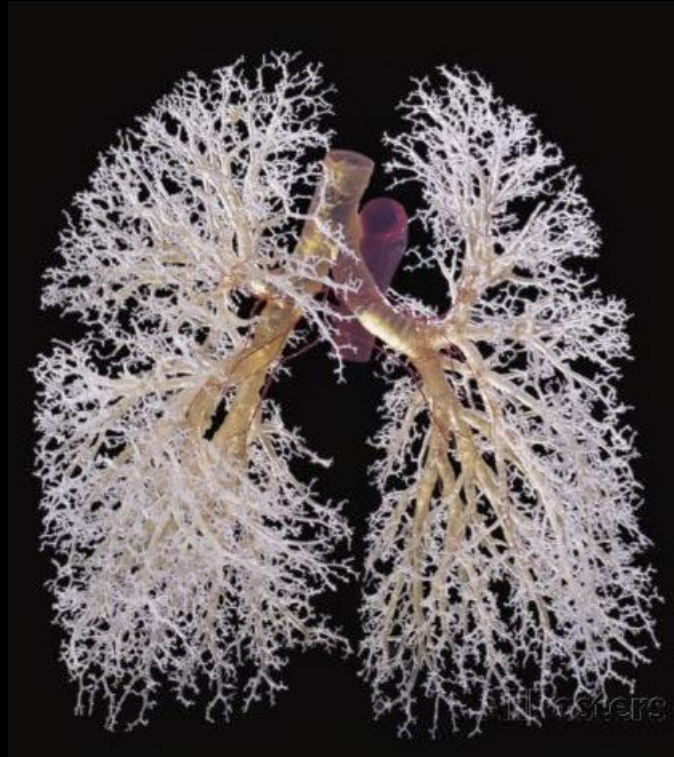




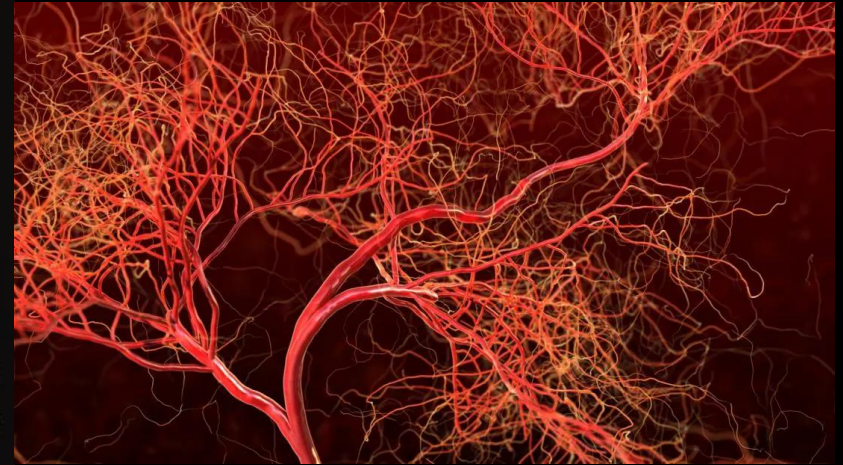
Fractals in Plants and Animals



Ferns



Lung Airways



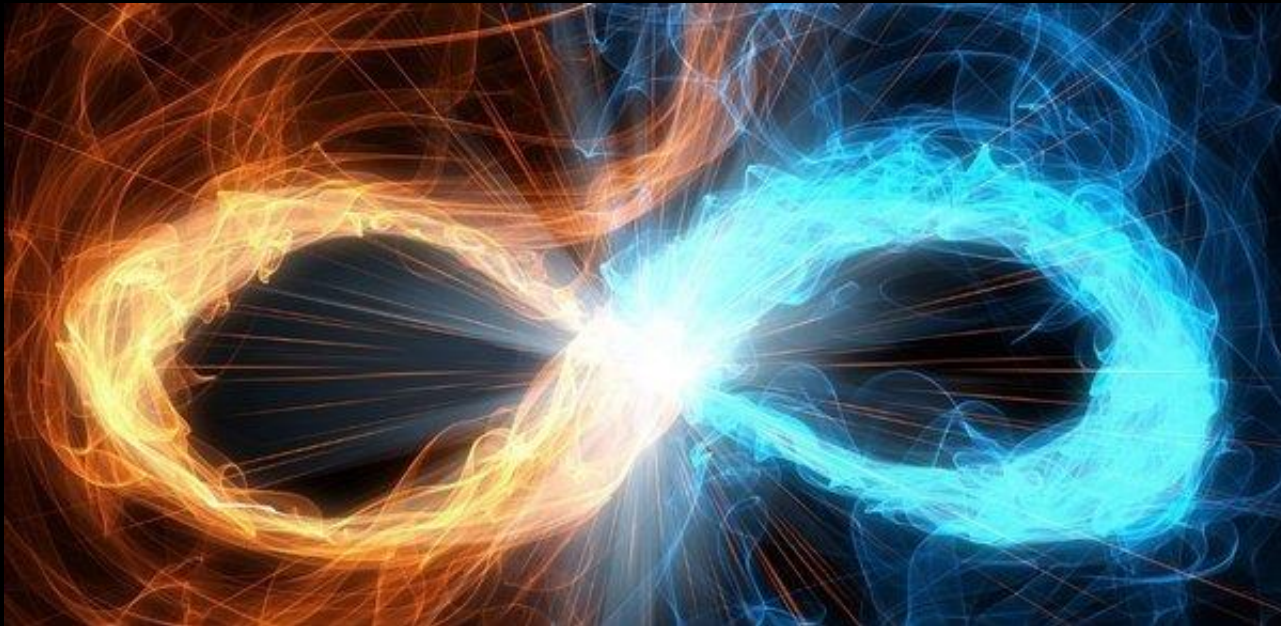
Heart Blood ways

Who can number the clouds by wisdom?
(Job 38:37a)



9

Infinity and Eternity



No matter how big a number is, it is always closer to zero than infinity.

Our Infinite and Everlasting Lord God

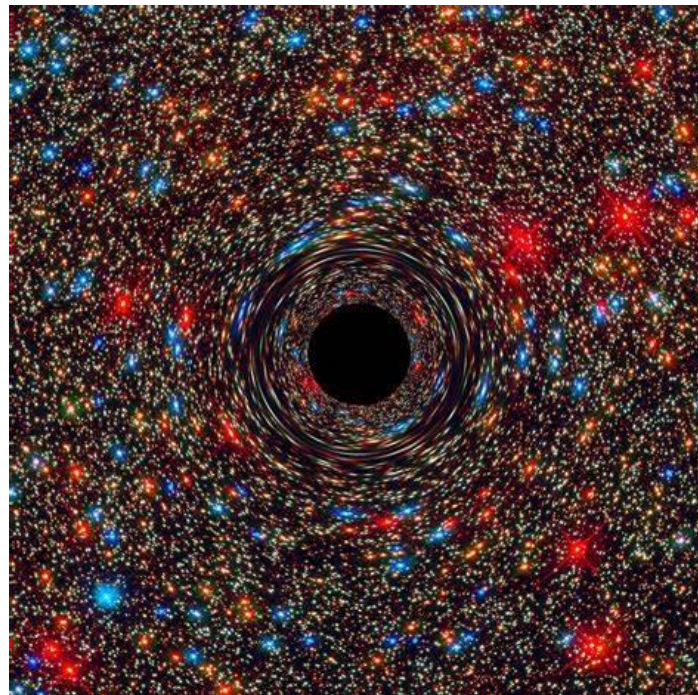
⁸ [God] who alone stretched out the heavens
and trampled the waves of the sea;
⁹ who made the Bear and Orion,
the Pleiades and the chambers of the south;
¹⁰ who does great things beyond searching out,
and marvelous things beyond number. (Job 9:8-10)

¹ Lord, you have been our dwelling place
in all generations.
² Before the mountains were brought forth,
or ever you had formed the earth and the world,
from everlasting to everlasting you are God. (Ps. 90:1-2)

The Bottomless Pit or the Eternal Falling

¹ And the fifth angel blew his trumpet, and I saw a star fallen from heaven to earth, and he was given the key to the shaft of the bottomless pit. ² He opened the shaft of the bottomless pit, and from the shaft rose smoke like the smoke of a great furnace, and the sun and the air were darkened with the smoke from the shaft.

(Rev. 9:1-2)



The Mandelbrot Set: $Z_{i+1} = Z_i^2 + C$ where Z and C are complex numbers



"Eye of the Universe"
Mandelbrot Fractal Zoom

Available in 4k

The House of the Father Scaled to Number of Occupants

¹ “Let not your hearts be troubled. Believe in God; believe also in me. ² In my Father's house are many rooms. If it were not so, would I have told you that I go to prepare a place for you? ³ And if I go and prepare a place for you, I will come again and will take you to myself, that where I am you may be also. ⁴ And you know the way to where I am going.” ⁵ Thomas said to him, “Lord, we do not know where you are going. How can we know the way?” ⁶ Jesus said to him, “I am the way, and the truth, and the life. No one comes to the Father except through me. ⁷ If you had known me, you would have known my Father also. From now on you do know him and have seen him.”

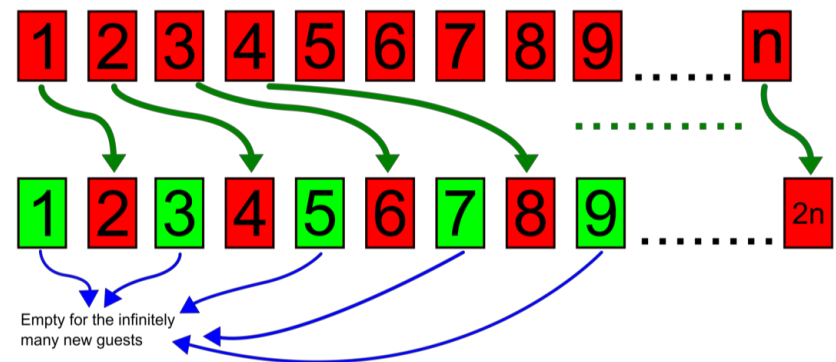
(John 14:1-7)

Hilbert's Hypothetical Hotel with a Countably Infinite Number (Aleph-1) of Rooms, All of which are Occupied

1. Hilbert's thought experiment illustrates the counterintuitive property of infinite sets
2. This hotel has an infinite number of countable rooms, each of which is occupied (Aleph-0 or \aleph_0)
3. Still the hotel can accommodate more guests, even an infinite number of uncountable new guests (Aleph-1 or \aleph_1)



HOTEL DE HILBERT



Mathematics Give Understanding to Some Mysteries, But Not All

¹⁸ Three things are too wonderful for me;
four I do not understand:

¹⁹ the way of an eagle in the sky, (aerodynamics)
the way of a serpent on a rock, (robotics)
the way of a ship on the high seas, (hydrodynamics)
and the way of a man with a virgin. (eros, phileo, storge, and agape love)

(Prov. 30:18-19)



Some Fly



Some Crawl



Some Swim



All Love