GIMNAZIJA DR. MATE UJEVIĆA U IMOTSKOM

SCIENCES AND MATHEMATICS INTO LEARNING ENGLISH

S.M.I.L.E.

Erasmus+ project KA229

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TANGRAMI AND ORIGAMI

MY CITY IN NUMBERS

MAY 2022

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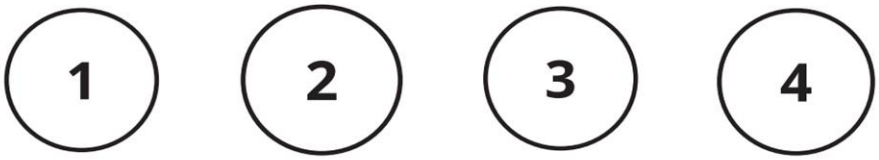
[Imotski]

in numbers

TANGRAMI AND ORIGAMI, MY TOWN IN NUMBERS

In Western civilization, today's numbers are used primarily because of their quantitative significance. For example, one means one thing, just as two means two things or something, etc. However, in philosophy, numbers were used at the beginning with regard to the other - qualitative meaning. In this sense, we are mainly talking about the symbolic meaning of numbers.



The ancient Greek philosopher and mathematician Pythagoras claimed that numbers govern everything, and Plato similarly said that numbers represent the highest form of knowledge as such. In their thinking, numbers were much more than just math. They concerned the cosmic order and the divine structure.

NUMBER 1

In the Neoplatonic philosophical tradition, especially with Plato, the number **1** is the number of unity, and as such a life-giving principle. Namely, everything that exists exists only under the guise of unity, regardless of whether it was biological or social organisms, because where there is discord, there will be death.

In Imotski, there is **1** Turkish tower known as Topana.

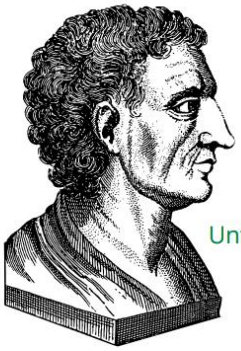
NUMBER 2

Dualism in philosophy means the opinion that there are two primordial, equal and irreducible categories of reality (two basic modalities, two primordial "substances", two constitutive principles of everything that exists): spirit and matter, ie idea and matter.

The town of Imotski is recognizable by its **2** lake; Modro i Crveno

NUMBER 3

Number **3** brings with it mostly good and sublime meanings. The Pythagoreans understood it as the first real number, since it is the number of the simplest geometric body - a triangle. Aristotle considered it the number of the whole or the number of a simple and therefore perfect plural, since it has a beginning, a middle and an end

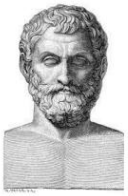


Until **3** centuries ago, Imotski was under Turkish occupation

https://povijest.hr/drustvo/narodi/turci-ili-osmanlije-koja-je-razlika/

NUMBER 4

Early ancient philosophy liked to talk about the **four** elements: earth, water, fire and air.



Tales: water
https://hr.wikipedia.org/wiki/Tales

Anaximenes: air
https://hr.wikipedia.org/wiki/Anaksimen

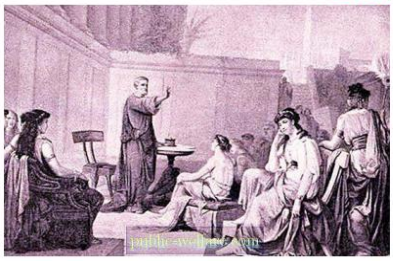
There are **4** high schools in my city:
Craft-industrial, Technical, Gymnasium, Economic

Empedocles introduced the theory of elements into philosophy. He claimed that the world was built of four elements (which he called roots): water, earth, air and fire.

https://hr.wikipedia.org/wiki/Empedoklo

NUMBER 5

FIVE, represents man, health and bodily love, and later also the fifth element - ether, which acts on the four lower elements. The study of the proportions of the human body is also associated with numbers, and five is symbolically associated with the pentagram.



Pythagoras and his followers the Pythagoreans spoke of the philosophy of numbers

https://hr.public-welfare.com/3971526-pythagoras-and-the-pythagoreans-pythagoreanism-in-philosophy

https://hr.wikipedia.org/wiki/Vlado_Gotovac

https://en.wikipedia.org/wiki/Ante_Rebi%C4%87

https://hr.wikipedia.org/wiki/Bruno_Bu%C5%A1i%C4%87

The **5** most famous people from Imotski are certainly the football player Ante Rebić, the writer Tin Ujević, the encyclopedist Mate Ujević, the journalist Bruno Bušić and the essayist, poet and philosopher Vlado Gotovac.

The philosophy of perfect numbers

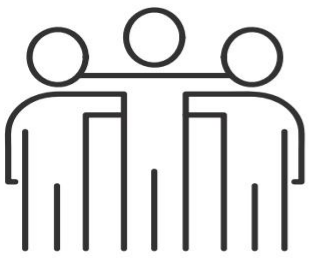
It is an integer equal to the sum of its divisors, including one, but not itself.

The ancient Greeks knew the first four perfect numbers: 6, 28, 496 and 8128. The Greek mathematician and philosopher of the Architect of Taranto proved that every prime number of the form 2m - 1 is associated with an even perfect number 2m - 1 (2m - 1). Eg the prime number 25 - 1 = 31 is joined by the perfect number 24 (25 - 1) = 496.

Only the philosopher L. Euler proved that every pair is a perfect number of Architect's forms. It is believed that there are no odd perfect numbers, although no one has yet.

NUMBER 10

The Decade (No. **10**) is expressed through the belief that the entire universe consists of a total of ten spherical bodies: the starry sky , the five planets, the Sun, the Moon, the Earth, and the Anti-Earth. Aristotle interprets in Metaphysics: "Since it seems to them (the Pythagoreans) that the number 10 is perfect and encompasses the whole nature of numbers, they claim that there are ten bodies wandering in the sky, but because they see only nine, they invent anti-earth as tenth ".



Currently, about **10**,000 people live in Imotski

PHILOSOPHY OF NUMBERS

Think!!!

The fact that you can't divide by zero is also known from school. However, many mathematicians consider this procedure to be part of a philosophical question and build complex theories around it.

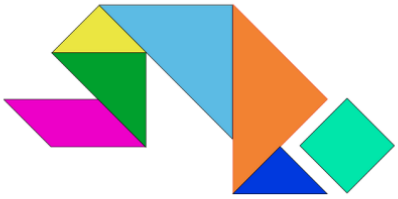
What do you think?

Should zero be considered a number at all if it represents nothing?

Is nothing really something?

ORIGAMI TANGRAM

Tangram puzzle is a two-dimensional puzzle with seven parts and with it you can create an infinite number of designs.



Hung Chang reference to Tangrams as being "a progressive philosophy with seven interpretations," . He says that Confucius makes several allusions to Tangrams, which he likens to "a game where the babes learn the form of things; youths exercise their wits; men study mathematics; artists get designs; poets fire the imagination, and the wise ponder over the past, present, and future. "

And for the end some interesting activities

https://toytheater.com/tangram/

https://naitreetgrandir.com/fr/etape/1_3_ans/fiches-activites/fiche.aspx?doc=coin-coin-des-emotions

https://www.youtube.com/watch?v=4kpL8IB4mQo

enjoy!

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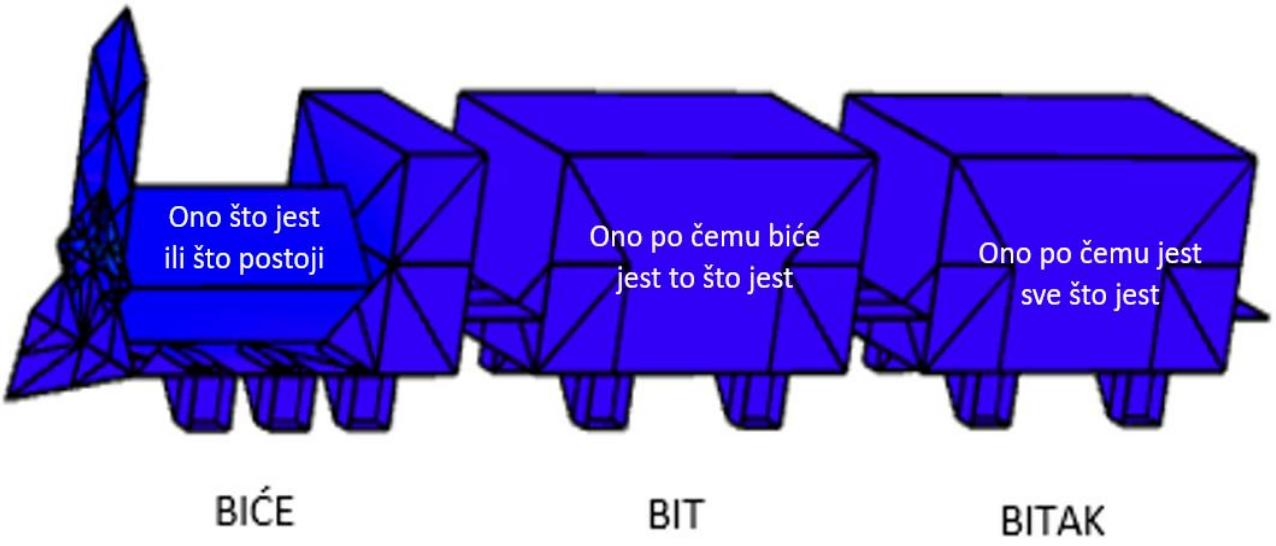
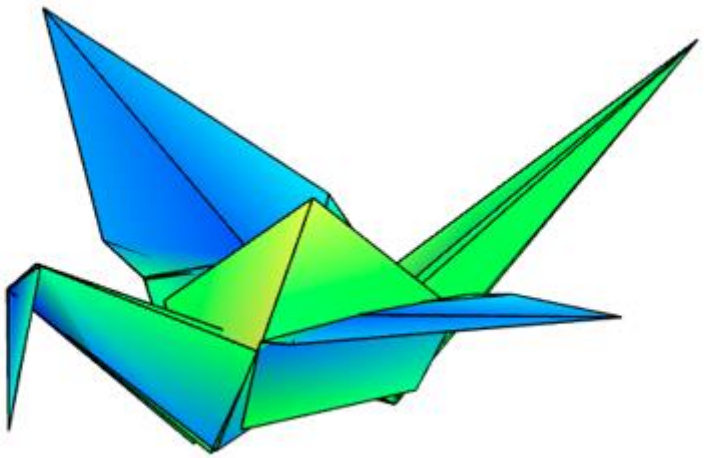
https://hr.wikipedia.org/wiki/Pitagorejska_%C5%A1kola

https://pubmed.ncbi.nlm.nih.gov/32848285/





My city in numbers

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„All things are numbers." – Pythagoras

Numbers through history

Interesting fact:

The history of numbers begins in the pit known as Border Cave where the oldest site of a mathematical record approximately 37,000 years old is located.

From the very beginnings of civilization, people have used numbers primarily to express ***quantitative*** values.

Later, with the development of history, religion, and philosophy, numbers are given ***qualitative*** meanings and they play the role of symbols.

The symbolism of numbers developed most in the period of **Ancient Greece** when one of the first philosophers began to shape their own numerical symbolism.

Numbers in philosophy

α	alpha	1	ι	iota	10	ρ	rho	100
β	beta	2	κ	kappa	20	ς	sigma	200
γ	gamma	3	λ	lambda	30	τ	tau	300
δ	delta	4	μ	mu	40	υ	upsilon	400
ε	epsilon	5	ν	nu	50	φ	phi	500
ϛ	stigma	6	ξ	xi	60	χ	chi	600
ζ	zeta	7	ο	omicron	70	ψ	psi	700
η	eta	8	π	pi	80	ω	omega	800
θ	theta	9	ϙ	koppa	90	ϡ	sampi	900

Ancient Greece number system

Plato and **Pythagoras** were among the first philosophers to use numbers and give them "more" meaning.

Plato claimed that numbers represent the highest form of knowledge and that as such they are much higher than mathematics itself.

Pythagoras believed that all relations in the universe could be reduced to relations of numbers. Pythagoras' philosophy of numbers gave mystical properties to numerical relations. So, for example the number 10 signified comprehensive, general, **ideal harmony.**

The first number of Pythagoras was called a **monad** – one, the first odd number, therefore represents the **divine number.** The monad represents the first being, initial mind; from him comes every thought in the universe.

Δδ

Δδ

A **dyad** emerges from the monad - It is geometrically represented with two points representing the **opposite poles** - good and evil, life and death. The dyad symbolizes movement, change, and birth.

Triad - Three symbolizes spiritual synthesis, the three points are connected in a **triangle** which of all the geometric symbols has the deepest meaning. It is a cosmic symbol that represents the Higher Trinity of the universe (the concept of Heaven and Trinity).

Tetrad - The four symbolize **the Earth**, the Earth space, the people on Earth with their earthly limitations. It is geometrically represented by **a square**, a cube, and also a cross. Many spiritual and material forms are composed according to the model of **quadruple** (eg four elements, four sides of the world, four seasons, etc.)

Pentad - number Five represents **man**, health and love, and also the fifth element - **quintessence (ether)**. The symbolism of man is obvious - four limbs and a head, which controls them. Geometrically, the number Five is symbolized by a **pentagram** and a five-pointed star.

Hexade - number Six. The two connected, interpenetrating triangles symbolize **the unity of spirit and matter**, and the masculine and feminine principles. This is also a symbol of the **human soul.** The ancient Pythagoreans considered it the perfection of all parts. They called **the hexagram** the form of all forms, the articulation of the universe, and the creator of the soul.

numbers associated with the city of Imotski

There are **eight** beutiful lakes in Imotski region.

There is **one** of the most beautiful stadiums in the world „Gospin dolac".

There are **two** Elementary schools, **four** High schools and **one** Music school in the city of Imotski.

In **1493**, Imotski fell under Ottoman rule.

In **1717**, the town of Imotski was liberated from the Ottomans.

In **1848**, the construction of the church of St. Francis was completed.

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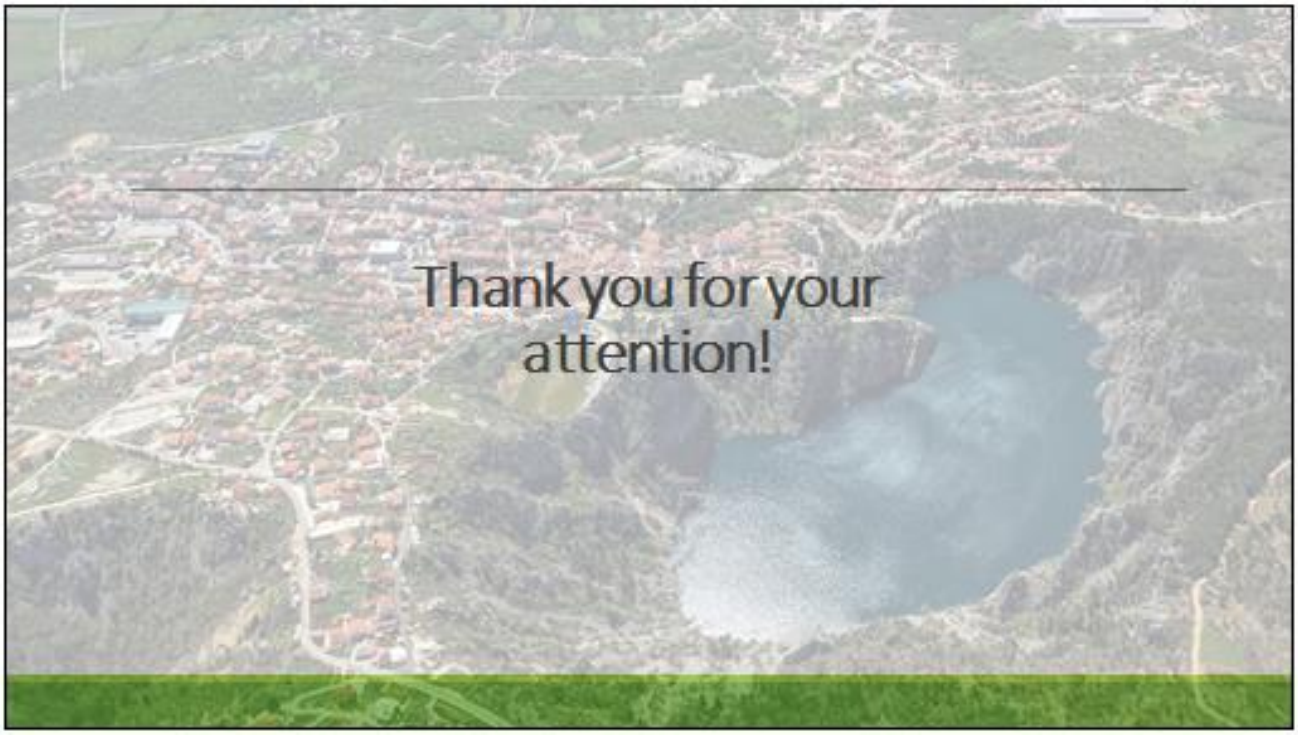
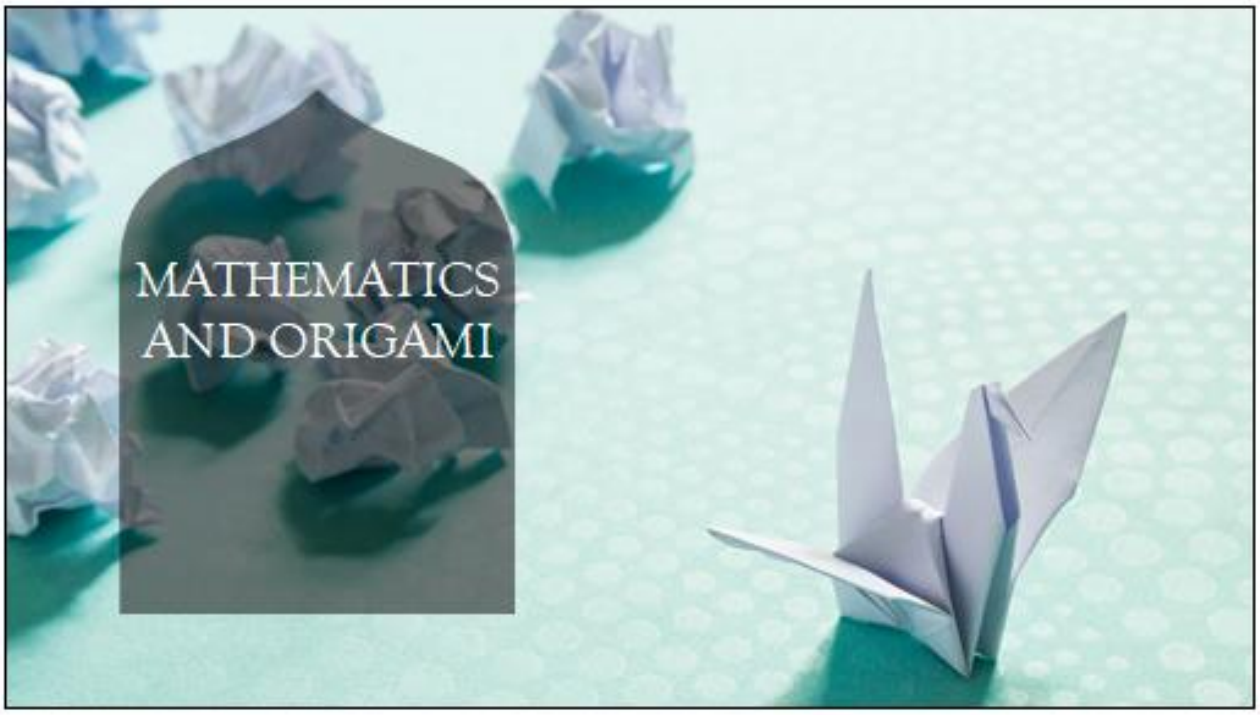
https://apps.lib.umich.edu/reading/Zenon/numerals.html





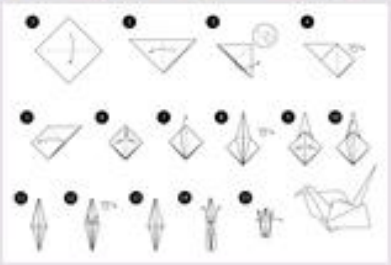
ORIGAMI

- old traditional japanese art of folding paper in various shapes without using scissors and glue
- Paper of one or two colors
- Thousands of different objects can be made with origami, from dragons, birds and flowers to various mathematical models

DIVISION OF ORIGAMI

TRADITIONAL

- using a single sheet of paper that has the shape of a square or rectangle



MODULAR

- connecting different individual parts into a whole

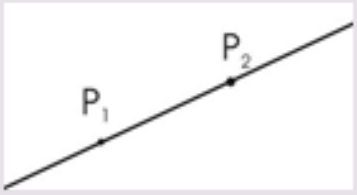
AXIOMS OF ORIGAMI

- Axioms: geometric rules that make up a series of steps in creating geometric constructions
- Huzita-Hatori axioms: 7 rules of origami construction by an Italian-Japanese mathematician Humiaki Huzita (1992)

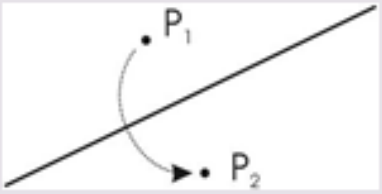
http://www.papercrane.org/attendees/JunMaekawa/portrait.jpg

RULES

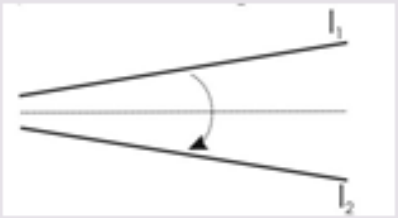
1. For two given points P1 and P2, there is a bending line passing through both points.



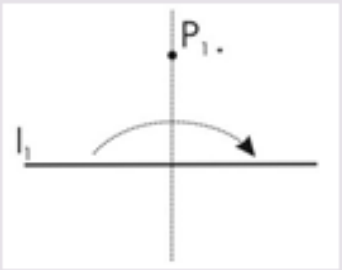
2. For two given points P1 and P2, there is a bending line that places P1 on P2.



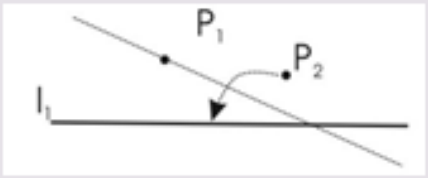
3. For two given directions l1 and l2, there is a bending line that places l1 on l2.



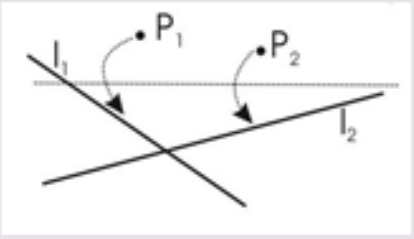
4. For a given point P1 and direction l1, there is a bending line vertical to direction l1, and passing through point P1.



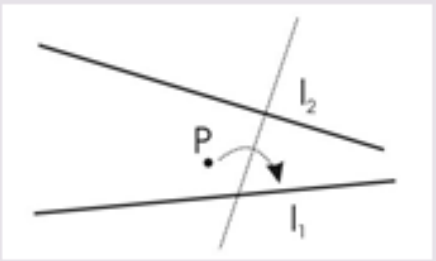
5. For two given points P1 and P2 and direction l1, there is a bending line that places point P2 on direction l1 and passes through point P1.



6. For two given points P1 and P2 and two given directions l1 and l2, there is a bending line that places point P1 in direction l1 and point P2 in direction l2.

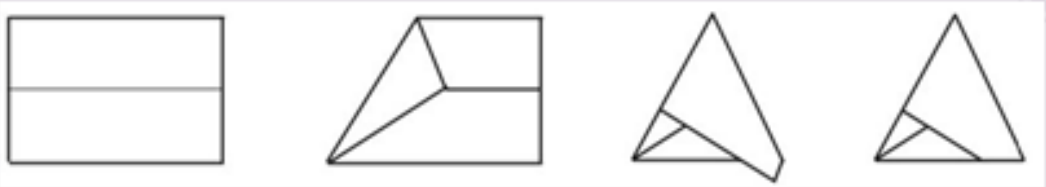


7. For a given point P and two directions l1 and l2, there is a bending line that places the point P on the direction l1 and is vertical to the direction l2.



EQUAL SIDE TRIANGLE

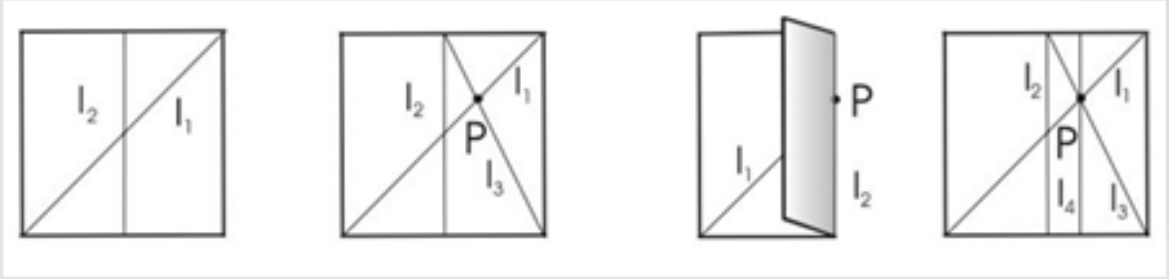
1. Fold A4 paper in half lengthwise
2. bend the upper left corner to the fold line so that the new bending line passes through the lower left corner
3. bend the upper right corner down so that the edge of the paper lies along the crease
4. fold the part sticking out at the bottom into the interior of the triangle.



DIVIDING SQUARES INTO THIRDS

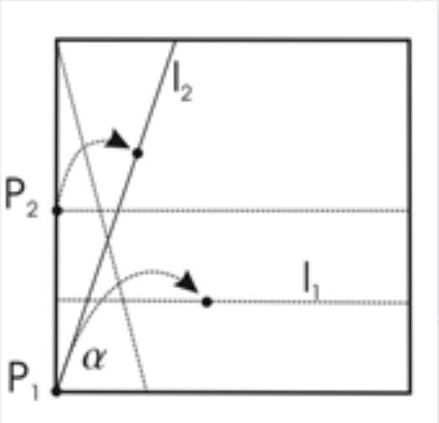
1. Take a square paper.
2. Fold the square in half and then diagonally.
3. Mark the fold obtained by bending diagonally with 11. It divides the square into two equal side triangles.
4. The fold obtained by folding the square in half is marked by 12. This fold divides the square into two rectangles.
5. Fold one of these two rectangles diagonally, and mark the resulting fold with 13.
6. The intersection of the folds 11 and 13 is marked by the point P.
7. Fold the paper so that the new fold passes through point P, and the edges of the paper overlap.
8. We mark this fold by 14. By folding 14, we divided the square into two parts: the larger part represents two thirds, and the smaller part one third of the square.

DIVIDING SQUARES INTO THIRDS



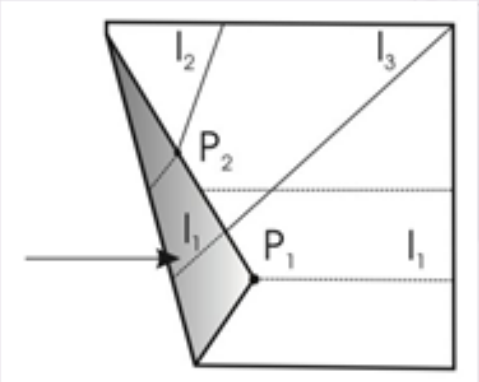
ANGLE TRISCECTION WITH ORIGAMI STRUCTURES

1. Select the angle (paper in the shape of a square) that we want to divide into three equal parts.
2. Make two parallel equally spaced folds at the bottom.
3. Mark the lower fold with l1, and the other leg of the angle with l2.
4. Mark the point P1 at the top of the angle we are observing, and P2 at the edge of the second fold.
5. Fold point P1 to direction l1 and point P2 to line l2.



ANGLE TRISCECTION WITH ORIGAMI STRUCTURES

1. In this position, fold the paper again along the fold l1 as in the picture, and then unroll it.
2. We got a new fold which we mark by l3.
3. Extend the fold l3 to the lower left corner.
4. The point P1 lies on the fold l3, and the fold l3 divides the angle α in the ratio 2: 1.



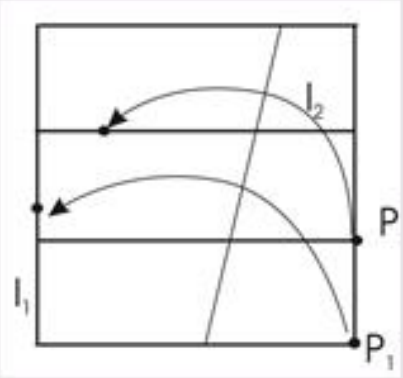
DUPLICATION OF THE CUBE BY ORIGAMI STRUCTURES

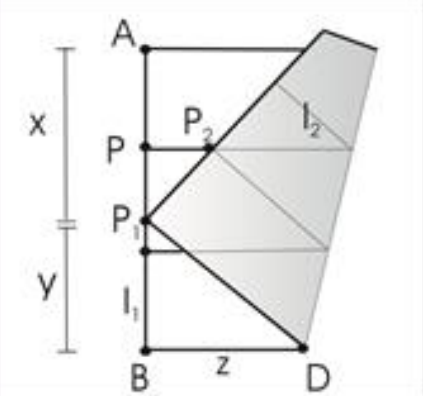
- Duplication of a cube with a edge length y: doubling the volume of that cube.
- By solving the equation $V_x = 2V_1$ we get that the edge length of the new cube has to be equal to $x = \sqrt[3]{2} \cdot y$

ORIGAMI SOLUTIOM:

1. Divide the paper by bending into thirds.
2. By bending, place point P1 on direction l1, and point P2 on direction l2.
3. Point P1 divides the side of the square into two lengths x and y.
4. The ratio of the lengths of these longitudes is exactly the number required

DUPLICATION OF THE CUBE BY ORIGAMI STRUCTURES



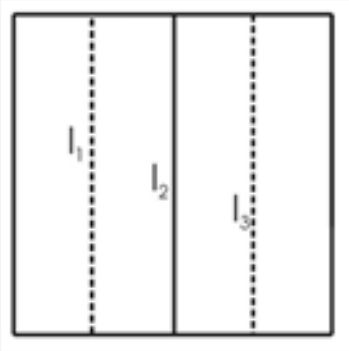


ORIGAMI IN MATHEMATICS

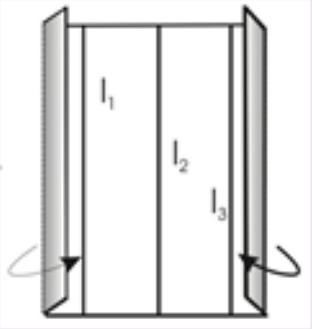
- visualization of certain geometric concepts
- representation of three-dimensional geometry, central and axial symmetry, polygons, Plato's bodies
- verticality, parallelism, intersecting directions, intersection of planes, conformity and similarity, surfaces

ORIGAMI CUBE

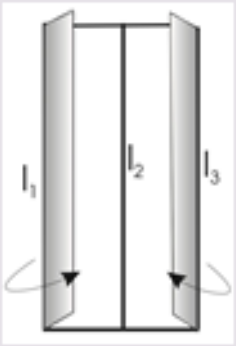
1. Fold a sheet of paper into quarters.



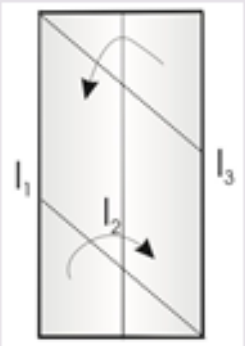
2. Fold the left edge of the paper to fold l1 and the right edge to fold l3.



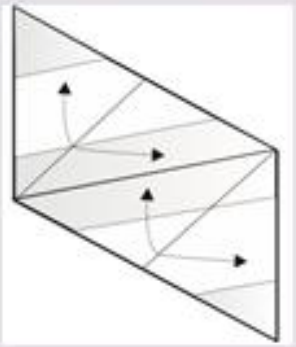
3. Fold the left edge of the paper inwards along the fold l1, and repeat the same on the right side.



4. Turn the paper over. Bend the upper right corner to the left and the lower left corner to the right edge of the paper.



5. Now fold the top tip along the right and the bottom tip along the left edge of the paper and straighten the tops.



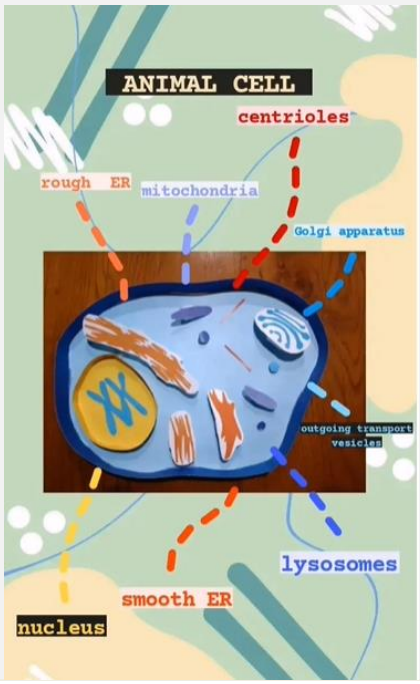
6. Repeat the procedure 6 times and connect the modules into a cube.

https://bit.ly/origami_cube

LITERATURE

- file:///C:/Users/Kosisnik/Downloads/03ljet%20(2).pdf
- https://pixabay.com/images/search/math%20and%20origami/
- https://www.origamiway.com/easyorigami.shtml

ORIGAMI IN BIOLOGY

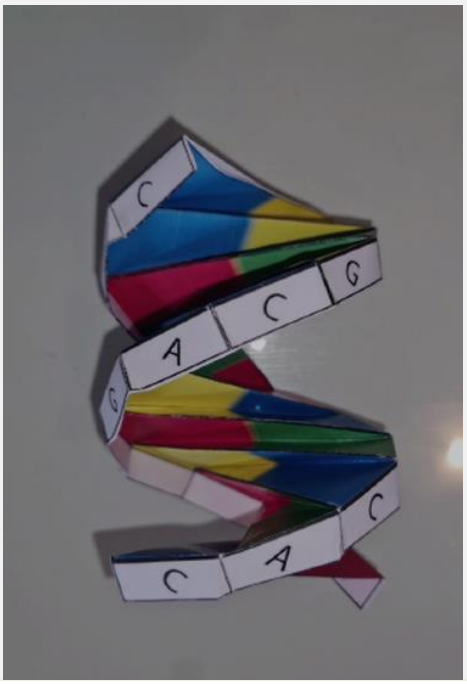


Animal cell and origami

https://bit.ly/origami_animalCell

Process of making miosis

https://bit.ly/origami_miosis



Making a model of DNA molecule

https://bit.ly/origami_DNA