

Grade / Age: 13-18 ages

Topic: Maths, engineering, drawing, IT, **STEAM**

Subject area: Spatial geometry, plane geometry

Keywords: Fractals, Pythagoras - theorem

Single/ team work: team

Language: (English or Local) English

Duration: Variable, see comment

Description of the Task:

Collecting fractals from nature, art (taking photos, internet research)

Plane and spatial Pythagoras tree- making from paper, manually, then in GeoGebra.

Solutions of the Task:

This task requires considerable teacher guidance. The first step is to clarify the concept of fractal according to the age group. Next is an exploratory work: collecting fractals from nature, art, examples to deepen the understanding of the concept of fractal.

The next task is to repeat the Pythagorean theorem and then link it to the concept of fractal.

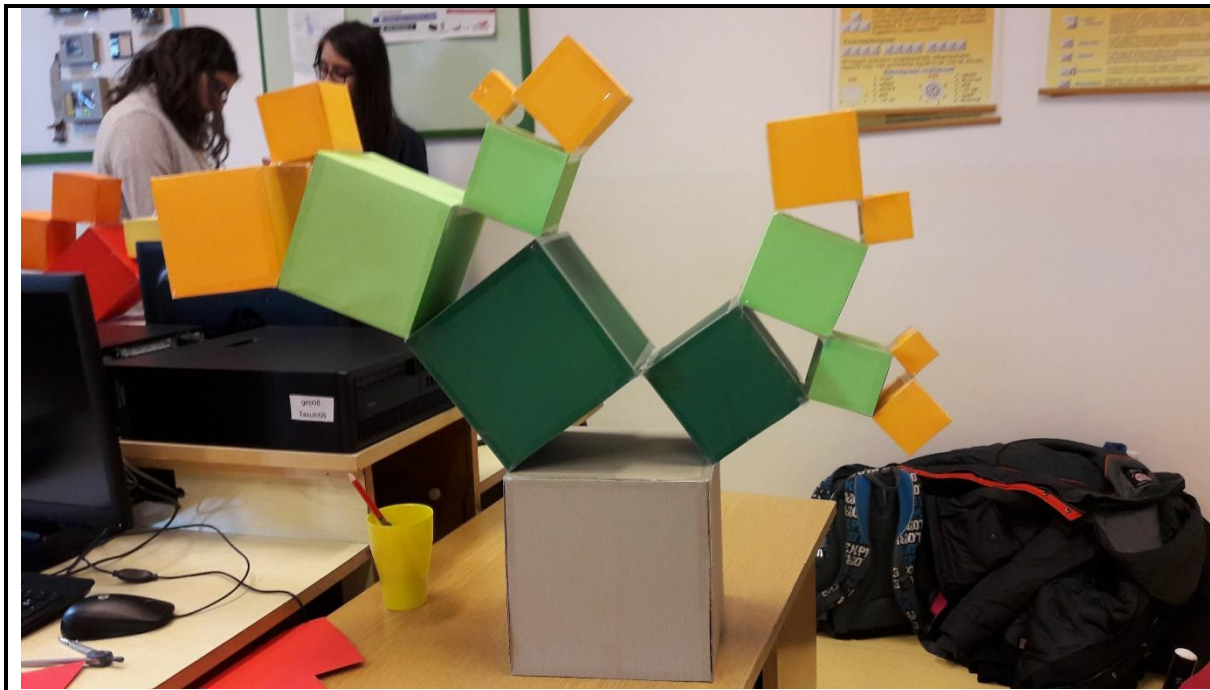
The steps of making a manual plane and spatial Pythagorean tree: planning, making templates, constructing squares in plane and cubes in space (to learn about the cubic grid: <https://learningapps.org/user/ebenye?displayfolder=35413>), making the Pythagorean tree, presenting the finished work, making a folder where students save the steps of the work, uploading photos of the finished structures.

GeoGebra: discussing the necessary editing steps, depending on the age group, the group's knowledge of GeoGebra (possibly a list, using the GeoGebra tool), presenting the work done.

<https://www.geogebra.org/classic/as8whtq2>

<https://www.geogebra.org/classic/muqzkdhr>











Prior knowledge:




Pythagoras - theorem, construct square, cube net

Comments:

The time requirement varies a lot, depending on many pieces and which ones from 4 parts (Pythagoras - tree manually in plane, in space, in GeoGebra, in plane, in space) will be done. Some of the preparatory parts can be integrated into the lesson, the whole exercise can be done in specialised sessions, even separated in time.

Plane Pythagoras -tree construction steps in GeoGebra:

#	Tool	Definition	Comment
1		Regular polygon: drawing a square	<i>ABCD square is the trunk of a tree</i>
2		Midpoint: midpoint of CD side E	
3		Circle: draw a circle with centre E and radius EC	
4		Shape point: we add a point on circle c, this is F	
5		Regular polygon: DFIJ square drawing square drawing FCGH	<i>DFIJ square and FCGH square are the branches of the tree</i>
6		Midpoint: JI → K HG → L	

7		<p>Circle: Draw a circle with centre K and radius KI Draw a circle with centre L and radius LH</p>	
8		<p>Point of shape: add a point on the circle e, this is M add a point on circle d, this is N</p>	
9		<p>Regular polygon: JMOP square drawing MIQR square drawing HNST square drawing NGUV square drawing</p>	<i>DFIJ square and FCGH square of tree twigs</i>
10		1-4 steps repeated	
11		Colour the figure appropriately	

Connection to other subjects/topics/areas:
 biology, technology, computer science, drawing