Good practices
INTER_503CD_EN

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Description of the problem / exercise: **Poly-Universe and the Sierpinski's triangle**

The relationship between Sierpinski and the Saxon triangle: The Saxon's poly-dimensional artwork below (Figure 1) was created independently of the Sierpinski triangle. In this exercise, we examine the work and find the geometric and mathematical relationships with the classical fractals.

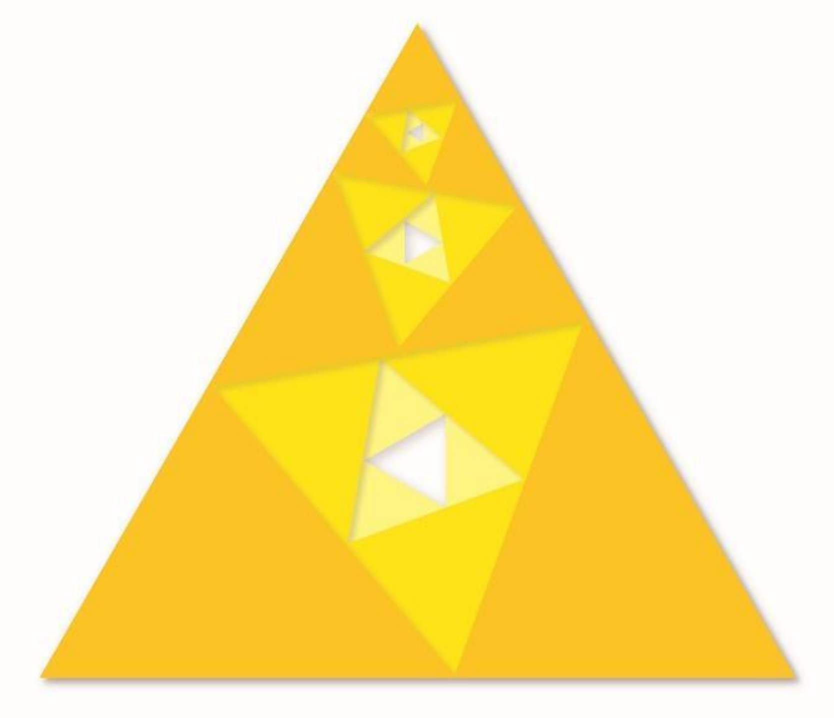

Figure 1: SAXON, Signe 2000, oil on wood 140×130 cm

1. Calculate the visible/remaining area of the two works.
2. Examine how the work of Saxon differs from the classical fractal.
3. Look for other similar examples in science, art, architecture…

Fig 2: A didactic illustration of SAXON's work

Steps in the construction of the Sierpinski triangle.

For the construction of the Sierpinski triangle, an equilateral triangle is usually chosen. However, this is not mandatory; any triangle can be made into a Sierpinski triangle.

This classic algorithm is also used to present the fractal:

1. Take a triangular plate
2. Draw your centrelines
3. Remove the center triangle
4. Repeat these steps for the resulting small triangles

At each step, the side lengths of the resulting small triangles are halved and their area is reduced to a quarter, while the middle triangle disappears.

In fact, the Sierpinski triangle is available as a limit: it consists of the points contained in each iteration step, that is, what remains of the triangle after an infinite number of steps. Computer representations perform the iteration ten times, because there is no visible change in the next steps for the human eye and the computer screen.

According to the classical area calculation methods, the area remaining in the iteration steps approaches zero.

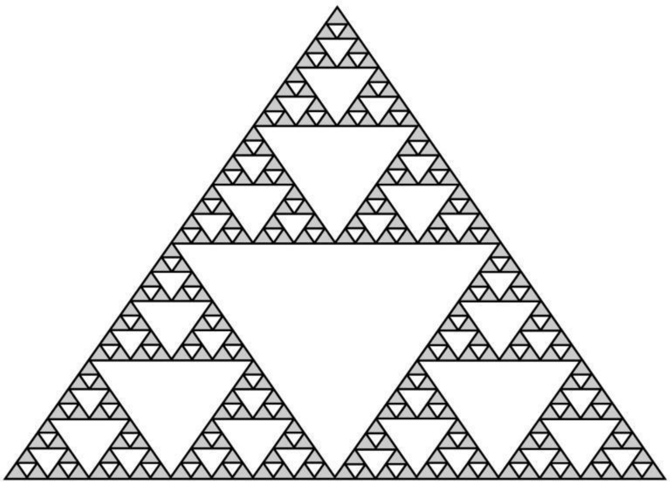

Figure 3: Sierpinski's classic fractal image: https://en.wikipedia.org/wiki/Sierpi%C5%84ski_triangle

There is only an aesthetic difference between the Saxon work and the Sierpinski triangle. The artist took advantage of the construction freedom to build the scaling in 6 steps only in the middle bar. He further solved the symmetry effect by tilting the smaller shapes at an angle of 15 degrees relative to each other. In addition, he did not take the smaller-scale forms out of the area but, while retaining his materiality, depicted them in different yellow tones. The Saxon triangle, while carrying the essence of the Sierpinski triangle, in reality reduced the area of the initial figure by only 1/64 + 1/256 + 1/1024.

In the 13th-century cathedral of the small Italian town of Anagni, for example, you can find mosaic tiles similar to the Sierpinski triangle, while there is a 700-year difference between the two ages:

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Figure 4: Cathedral of Anagni, Italy, 13th-century

- *Why this exercise is good:* Interdisciplinary approach. The relationship between fine arts, architecture, and mathematics. Relationships between art history and the history of mathematics.
- *Level of teacher training:* Secondary school, teacher training
- *School subject(s):* Art & mathematics, architect
- *Comments:* Look more than similar examples in science, art, architecture…