Good practices
PROG_206CD_EN

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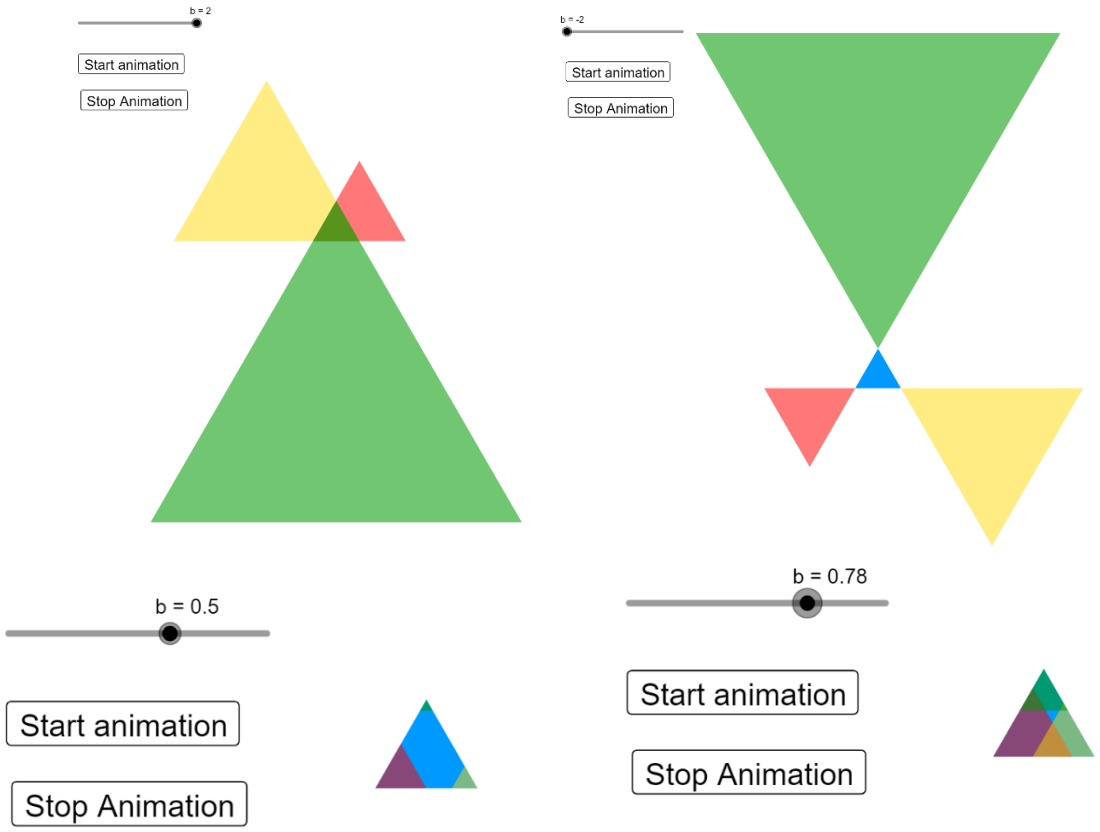
Description of the problem / exercise: **Poly-Universe and GeoGebra — Changing ratios**

The inventor of the Poly-Universe János Szász Saxon also experimented with different proportions, and not only inwards, but also outwards from the basic form, i.e. with a negative ratio. The figure below shows the variations of the ratio 'b' of the triangular form in 4 different cases: -2 ≤ b < 0, 0 < b < ϕ, ϕ < b <1, 1 < b ≤ 2, where $\phi = \frac{\sqrt{5}-1}{2}$, the rate of the golden ratio. The golden ratio first came up when we thought of a 3-dimensional extension of the Poly-Universe square. A smaller cube was placed in each of the 8 vertices of a cube, each cube being reduced to ½ of the previous one. From vertex 6 onwards, the cubes were almost invisible. The question arose how far the ratio could be increased so that the two largest vertex shapes did not overlap? We then solve $a = \lambda \cdot a + \lambda^2 \cdot a$ equation for λ, where λ is the similarity ratio and 'a' sign the side length of the base cube. The positive solution to the second-degree equation will be the golden ratio. The figure below shows the result for 4 substantially different ratios, the bottom right image shows an edit with a ratio ϕ< b <1. The most interesting thing here is the effect of the translucent colors on each other.



https://www.geogebra.org/classic/ktsurehf
https://www.geogebra.org/classic/zkncndfk

- *Why this exercise is good*: The edits above can provide countless outsights and points of connection. First of all, there are mathematical connections. We can talk about the properties of the enlargement from point for different proportions, the area of similar polygons, but the golden ratio is also related to art as well as mathematics. The ratio of the golden section appears in countless paintings, buildings, music, but also in our everyday objects (e.g. a bank card is a golden rectangle) and in familiar logos.
- *Which level is recommended*: secondary school, teacher training (mathematics, IT)
- *School subject(s):* Mathematics, IT, arts