AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES
SCHOOLS ENRICHMENT CENTRE (AIMSSEC)
AIMING HIGH

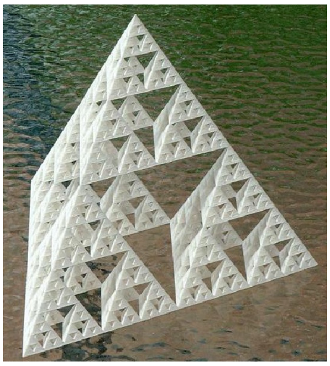
SIERPINSKI NUMBER AND SHAPE PATTERNS

The question is how many little tetrahedra, like the blue model shown, were used to make this 6.5 metre high red balloon model tetrahedron. It was built in a shopping mall in Cambridge, UK to set a Guinness World Record.

The smallest tetrahedron, the blue model (Stage 0) is made from 6 balloons, each 25 centimetres long.

In a perfect model the green (Stage 1 – 50cm) tetrahedron, made from four 25 cm pyramids, would have edges of length 50 centimetres.

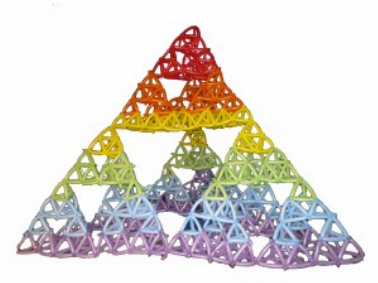
Then 4 of the Stage 1 tetrahedra are used to make the Stage 2 – 1 metre model, and 4 of those to make the next one Stage 3 – 2 metres, and so on, and so on. At each stage of the construction 4 tetrahedra are used to make a bigger tetrahedron and the lengths of the edges are double the lengths of the edges at the previous stage.



This white 3D printed model shows the construction of the red balloon model.

The red balloon model was made from 1024 small tetrahedra with edges of length 25 centimetres. Clearly it was not a perfect shape like the white model, but if it had been then the edges would have measured 8 metres.

The rainbow tetrahedron is a Stage 4 – 4 metre construction made with 4 of the Stage 3 – 2 metre tetrahedra.



There are many other questions about number patterns and geometry that you can investigate based on this structure. Let us know what you find out.

HELP SIERPINSKI TRIANGLE

Use triangular grid-paper if possible and make your fractal as big as possible.

Step One Draw an equilateral triangle with sides of 2 triangle lengths each. Connect the midpoints of each side. How many equilateral triangles do you now have?

Shade the three outer triangles. Alternatively, think of this as cutting a triangular hole in the triangle.

Step Two Put three of these patterned triangles together. Alternatively draw another equilateral triangle with sides of 4 triangle lengths each and mark the edges into 4 equal lengths. Shade the nine small triangles as shown. Note the larger 'hole' and the three smaller 'holes'.

Step Three Put three of these patterned triangles together, that is nine of the patterned triangles from Step One. Alternatively draw an equilateral triangle with sides of 8 triangle lengths. Shade the 27 small triangles as shown. You will have 1 large, 3 medium, and 9 small 'holes'.

Step Four **How about making a poster?** If each member of your class makes one of the patterned triangles from Step Three, then 3 of them can be assembled to make a patterned triangle as in the diagram below, or 9 or 27 (or even 81…) can be assembled to make patterns getting closer to a Sierpinski Triangle Fractal. Use your artistic creativity to shade the triangles in interesting colour patterns.

NEXT

To develop your investigative and communication skills, choose and investigate one aspect of the construction of a giant Sierpinski Tetrahedron and write up your findings. Different learners could pursue different investigations to answer different questions (see the list in the 'Why do this activity' section). A project like this offers the opportunity for you to prepare a report, to make your own models and posters and give a talk to present your discoveries to the whole class.