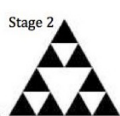
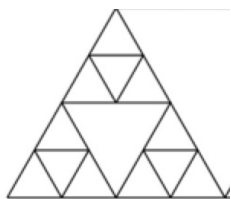


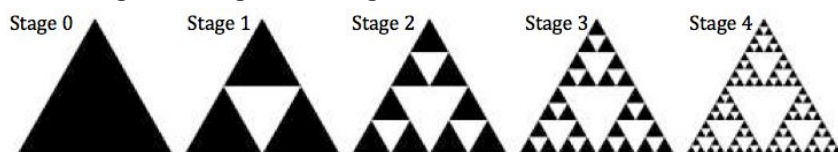
THE 30-MINUTE FRACTALS LESSON FOR EARLY YEARS, LOWER PRIMARY AND SUPPORT FOR OLDER STUDENTS



Start by watching the video <https://youtu.be/CWdmkoZgIoA>

Each student should have a stage 2 Sierpinski triangle of edge length about 4.5 cm and a colouring pen, and should colour their triangle as shown by the black filling in the small diagram. (Older students will colour Stage 3 triangles.)

According to the age and stage of the learners the class will make a **Stage 4 or Stage 5 poster**



You can see how, at each stage, 3 triangles are used to make up the Sierpinski triangle at the next stage. A stage 3 triangle is built from 3 stage 2 triangles, a stage 4 triangle is built from 9 stage 2 triangles and a stage

5 triangle is built from 27 stage 2 triangles.

A fractal is infinite and these triangles are just building blocks. Imagine this process going on forever to form the Sierpinski fractal, by growing out getting bigger and shrinking in getting smaller.

If you want to extend the 30-minute lesson, and if you have enough time and space, if you have a big class, or if several classes combine their efforts, you might make a stage 6 poster with 81 stage 2 triangles.

This activity should help learners to appreciate how fractals are self similar repeating at different scales.

In the activity a fractal pattern is made that grows outwards getting bigger. A true Sierpinski fractal is the result of a similar process that repeats infinitely many times by making triangular holes (like the white triangles) at smaller and smaller scales inside itself. As humans we cannot actually complete a task that goes on forever or see the infinitesimally small structure inside the fractal but we can try to imagine it.

NOTES FOR TEACHERS

RESOURCES NEEDED

- A. Copies, already cut out, of **stage 2 Sierpinski triangles** (edge length about 4.5 cm) for children to colour where it is black in the image above, one each and some to spare so if they make mistakes they can start again. See page 2.
Note: older children will be given stage 3 triangles to colour which are more complicated.
- B. Colouring pens, one for each child.
- C. Backing sheet for the poster - A2 size for stage 5 poster (27 children's stage 2 triangles). Draw a faint line in pencil parallel with the bottom edge and about the width of a ruler up. Fix your sheet up ready on the wall, with BluTak, Prestik or drawing pins, or on a stand or placed for all to see - ready to paste the coloured triangles onto it.
- D. Glue (Pritt or UHU sticks or similar).
- E. Globe (optional)
- F. Broccoli (optional) to break up to demonstrate fractal structure if you don't show the video in the lesson.

Why do this activity?

Each year a 30-minute lesson on an important cross curricular theme is taught on the same day in thousands of schools around the world. Learners of all ages enjoy a one-world experience with other young people. A collection of follow-up activities for all ages, relating directly to the school curriculum, enable teachers to plan exciting lessons to deepen their students understanding of the topics that they need to study and to explore applications of school mathematics. The Fractals in Maths, Science, Nature and Art collection provide activities on number patterns, geometric patterns and other topics.

Learning objectives

Counting in 3's, multiples, number patterns, geometric patterns, appreciation of an infinite iterative process and its applications to human biology and nature, visualisation

Generic competences

Teamwork. Ability to work systematically. Experience and appreciation of belonging to one human family. Visualisation.

Suggestions for teaching

ACTIVITY	Duration in minutes	Time
1. Tell the class that today's lesson is special because thousands of schools around the world will be doing the same lesson. You could show a globe and talk briefly about children around the world and night time in India when it is daytime in America and vice versa.	2	2
2. Either show the video	3	5
Or before the lesson, watch the video several times yourself and prepare to tell the class about fractals. You could use broccoli as an example and break it into pieces to show self similarity on different scales. Explain that the class will make a poster of a Sierpinski triangle that would be come a fractal if it continued to grow outwards and inwards forever.	3	5
3. Each child should have a stage 2 triangle and a colouring pen. Explain that they must colour their triangle in one colour, exactly as shown (draw one on the board or show a slide).	3	8
4. As soon as the first coloured in triangles are ready start inviting the children to cover the back with glue, and bring their triangle to stick on the poster, starting at the bottom left hand edge placing all the lowest triangles carefully on the pencil line. Complete a stage 3 triangle with 3 stage 2 triangles before sticking any more to the right. Stop the class and very briefly draw their attention to the stage 3 triangle just completed . Appoint the first 3 children who have already stuck their triangles on the poster as monitors to organise 3 queues to come to the board with glued triangles ready to stick them on the poster with guidance from the teacher.	5	13
5. Stick 6 more stage 2 triangles on the backing sheet so that the 9 stage 2's together make a stage 4 triangle. Briefly draw the attention of the class to this stage 4 Sierpinski triangle .	5	18
6. EITHER stop there and talk about the patterns and shapes, OR Stick another 9 stage 2 triangles at the same level and another 9 above so that the 27 stage 2's together make a stage 5 triangle. Draw the attention of the class to this stage 5 Sierpinski triangle they have completed .	7	25
7. Take a photo of your class with their poster.	5	30

Key questions

What do you notice?

Can you explain what happens from one stage to the next?

What happens to the number of **coloured in triangles** from one stage to the next?

What do you notice about the number pattern for the numbers of **coloured in triangles** at each stage?

Possible extension

The class could make a Stage 6 poster with 81 stage 2 triangles.

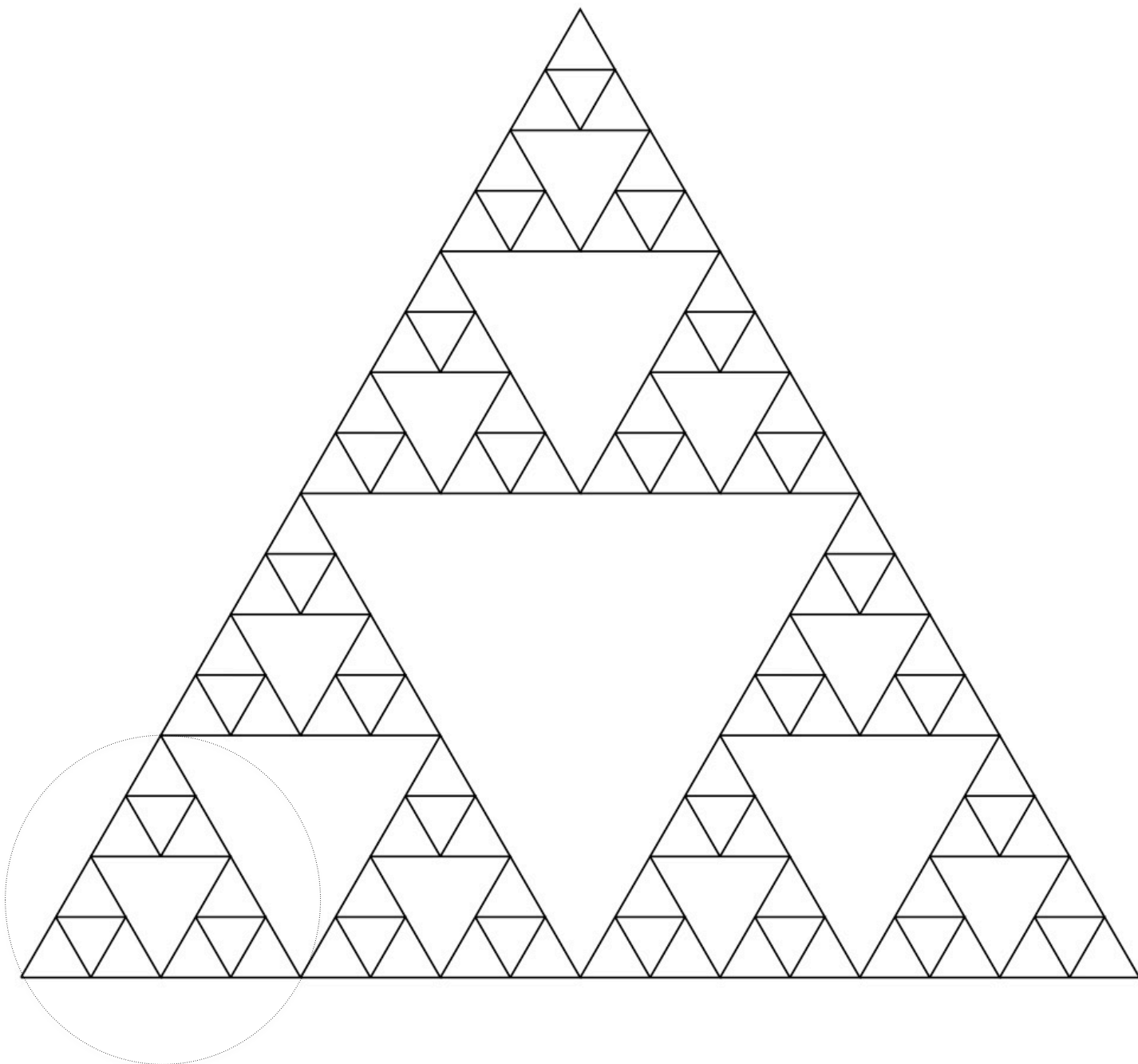
On the AIMING HIGH website use the TOPIC SEARCH and select Fractals and GML to find more activities on Fractals for different age groups.

Possible support

Have the triangles already coloured if the learners are not able to colour them in themselves.

Just make a stage 4 triangle from 9 stage 2 triangles.

9 stage 2 Sierpinski triangles making a stage 4 Sierpinski triangle.
For young learners photocopy this page and cut out the 9 triangles for children to colour to make a poster.
They could make a stage 5 poster with 27 stage 2 triangles.



Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and up to Secondary 5 in East Africa. New material will be added for Secondary 6.
For resources for teaching A level mathematics see <https://nrich.maths.org/12339>
Note: The mathematics taught in Year 13 (UK) and Secondary 6 (East Africa) is **beyond the school curriculum for Grade 12 SA.**

	Lower Primary or Foundation Phase Age 5 to 9	Upper Primary Age 9 to 11	Lower Secondary Age 11 to 14	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6