Fractals
Teacher Information Sheet

This activity can be run with KS4 students and involves making paper representations of fractals (a topic not usually introduced until university) and gives the opportunity to investigate some of their mathematical properties.

Students should have pencil, scissors.

Suggested timings:

- 5+ minutes Discussion of when/how maths is discovered through quiz (answers a, c, false, c respectively). Emphasise new maths is being discovered all the time. Fractals is a fairly new area of maths – discovered in the 70s/80s.
- 5+ minutes Slides 7-14 – making the dragon curve – students need a strip of paper. The curve is made by repeatedly folding the strip in half. At each stage the paper is unfolded so that all the edges are at right-angles. Very quickly quite an intricate pattern appears – and the sides never double up. It can be use to tile the plane. For more interesting properties see: http://en.wikipedia.org/wiki/Dragon_curve
- 15+ minutes Students make a representation of the Sierpinski Gasket (use link from slide). It may be useful to for them to begin with the grid provided to assist in making the appropriate cuts. Explanation of what a fractal actually is – fractals are often generated by a simple rule like in the activity they have just done, and within the fractal you can often see copies of the whole shape (self similarity)– can the students see that in their Sierpinski Gaskets? Use the link from the slide to explore Sierpinski's Gasket further – as the iterations increase what happens to the area? It tends to zero!
- 15+ minutes Introduce the Koch Snowflake and how it is constructed. See student worksheet through which students will find that the perimeter tends to infinity but the area of the shape remains bounded.

Guide to further slides:

Uses of fractals include

a) Generation of landscapes in film – actual images need a lot of storage but only a few rules are needed to generate a fractal landscape
b) The Human Body makes use of fractal shapes for instance the structure of the lungs. Why? – the volume of the lungs has to be bounded (it needs to fit in the chest!) but we need the surface area to be as large as possible
c) Fractal antenna – again a bounded area but very large perimeter!

The message we wanted to emphasise was that maths is everywhere, fascinating and extremely useful!

A good website used above but with much more content is
http://www.motivate.maths.org/conferences/conference.php?conf_id=19

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