Workshop 2 Question Sheet

Question 1:

In the first part of this workshop, we're going to build a fractal known as the Sierpinski Pyramid or Tetrix (generated from the Sierpinski Triangle).

You should all have a piece of paper with a net of 2 triangular-based pyramids. You'll need some glue, tape, and scissors to cut out the nets and form the pyramids. You will then work in pairs to join your 4 pyramids together to make a larger fractal.

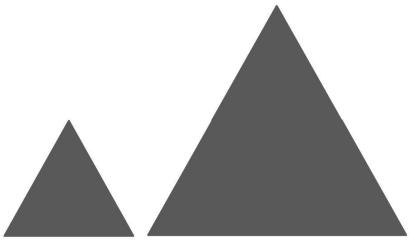
1. Cut out each of the nets, making sure you leave the flaps on
2. Fold along the flap lines and the thicker black lines that mark the edges of each triangle
3. Try and form the triangular-based pyramid shape before using any glue so that you can visualize what you're going to end up with and how you need to fold once you've added the glue
4. Put some glue along each of the flaps then form the triangular-based pyramids
5. Ask your tutor for some tape, and, in pairs, attach together the 4 pyramids in the same way as the model at the front of the room

You now have a Sierpinski Pyramid - note that this has a dimension of 2!

Question 2:

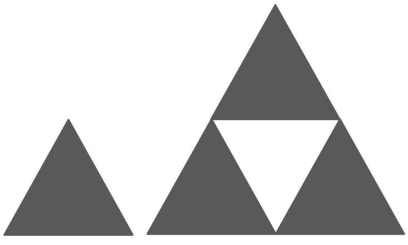
Now we are going to work out the **Hausdorff Dimension** for the **Sierpinski Triangle** in a similar way to how we worked out the dimension of the Menger Sponge.

a) We start with a triangle of side length 1. When we increase the side length by 2, how much does the total area of the triangle increase?



(hint: we can do this by considering how many of our smaller triangles fit inside our bigger triangle)

b) Now we look at our Sierpinski triangle and try to find how much the area increases. When we look at our simplified Sierpinski triangle, how many smaller triangles fit inside our triangle with side length 2? Call this number y.



c) Substituting our answer to part 2 as y, we can make an equation like the one used to calculate the Menger sponge in session 2.

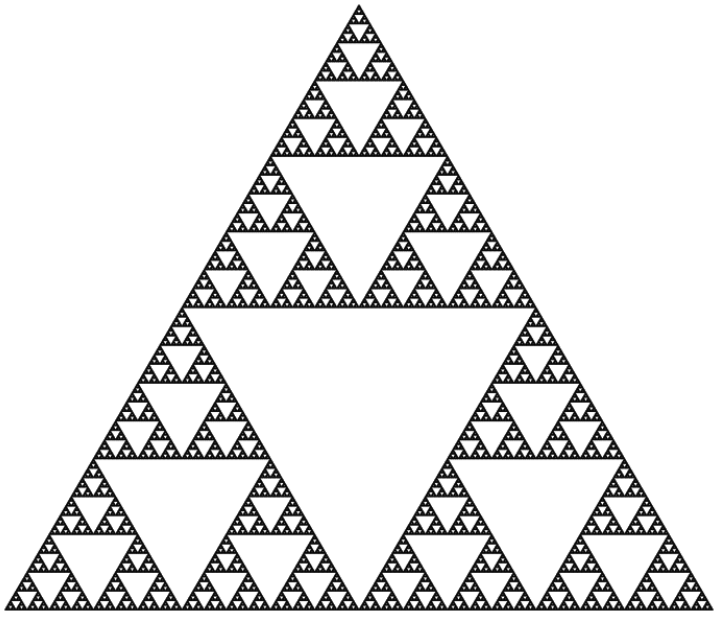
$$2^x = y$$

Find x to 3 decimal places.

This will be the dimension of the Sierpinski triangle.

(hint: Try substituting different numbers between 1 and 2 in for x and using your calculator to get as close to y as possible. It's ok if you don't find an exact value for x. Using the table below to keep track of your values may be helpful)

x	2	1	1.5	1.6							
$2^x = y$	4	2	2.83								
$< y$		✓	✓								
$> y$	✓										



Here is a non-simplified Sierpinski Triangle!