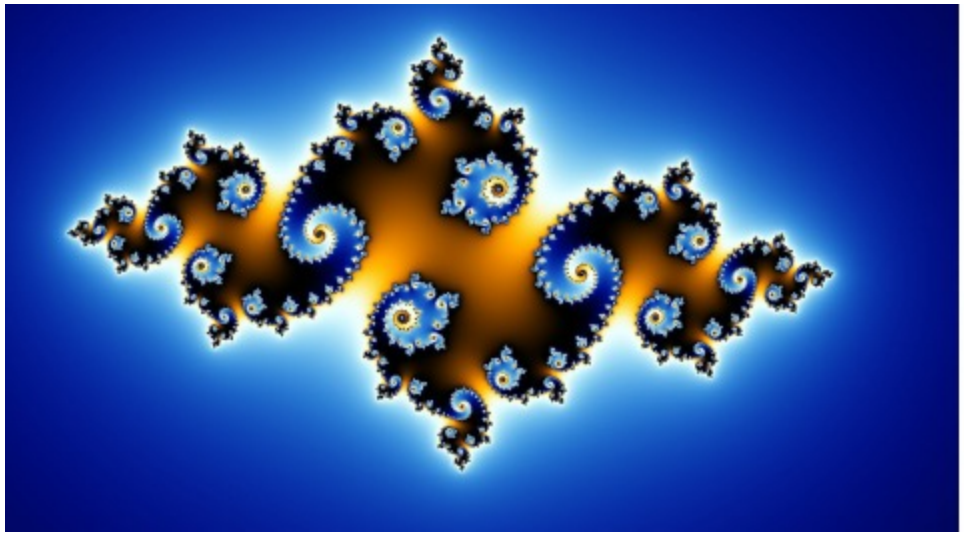
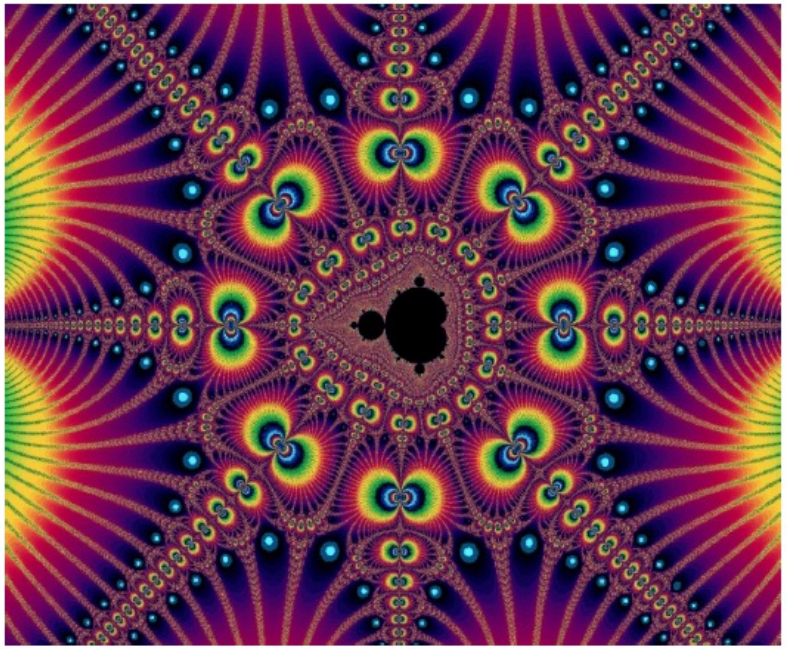
FRACTALS

What is a fractal?

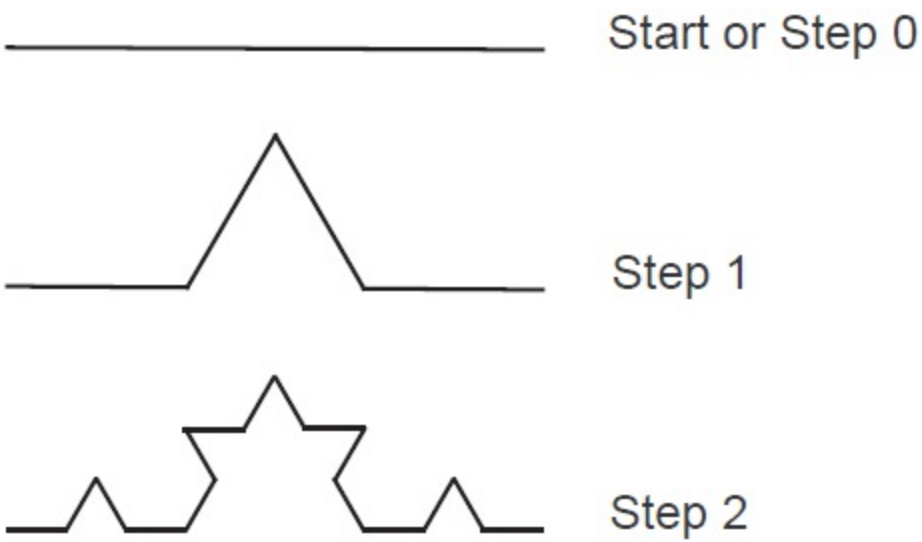
- It’s a pattern that repeats itself in a never ending manner across all scales.

Some examples



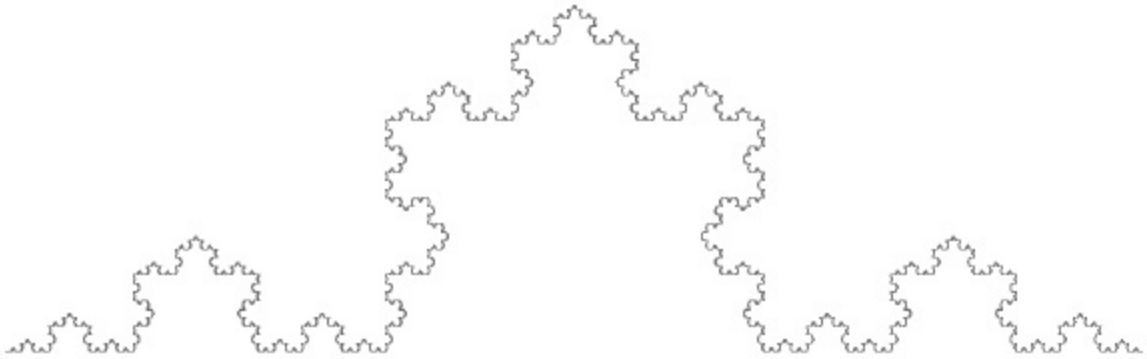


Drawing a fractal – Koch Curve



Can you draw Steps 3 and 4?

As n becomes very large…



Complete the tables

Number of segments

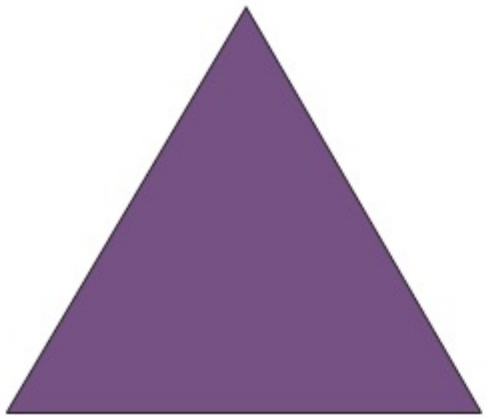
Step	0	1	2	3	4	n
Number of Segments	1	4	16			

Length of segments

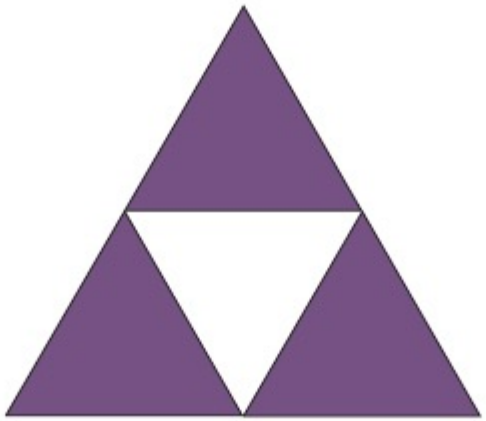
Step	0	1	2	3	4	n
Sum of the Segment Lengths	1	$4 \cdot \frac{1}{3}$	$16 \cdot \frac{1}{9}$			

How long does the Koch curve eventually get?

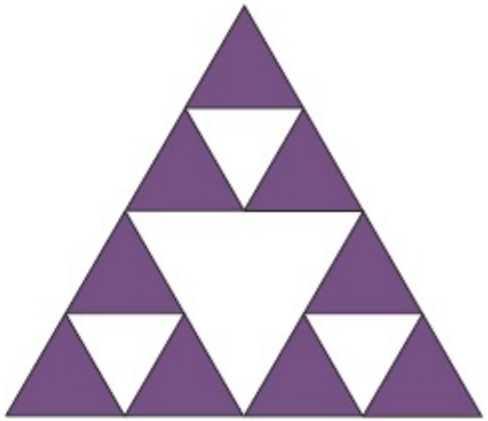
Serpinski Triangle



Stage 0



Stage 1



Stage 2

Can you draw Steps 3 and 4?

Complete the tables

Number of triangles

Stage	0	1	2	3	4	*n*
Number of Triangles	1	3	9			

Area of shaded region

Stage	0	1	2	3	4	*n*
Area of Shaded Region	1	3/4				

How long does the Serpinski Triangle eventually get?

Fractals around you

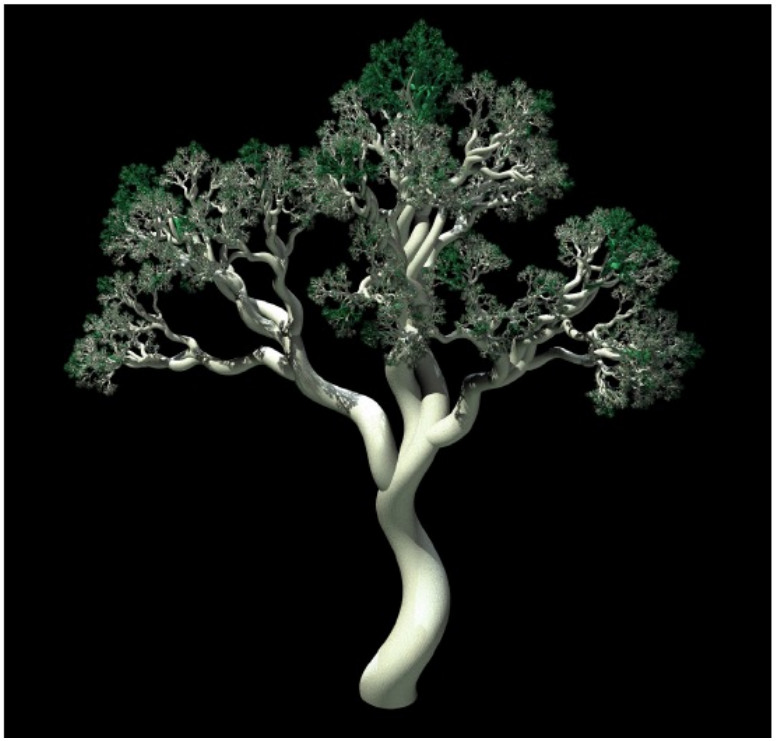
- Can you name some fractals in nature that you have seen?

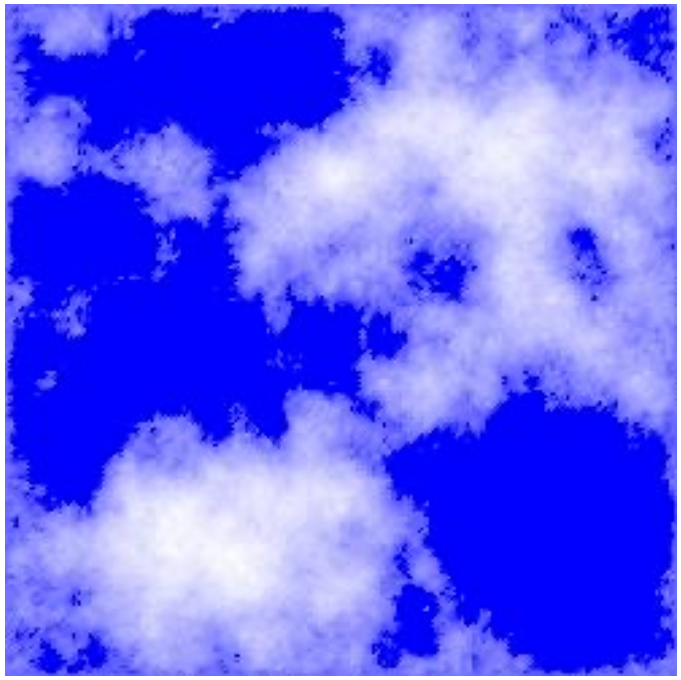
Fractals in nature

A fossilized ammonite from 300 million years ago. A simple, primitive organism, it built its spiral shell by adding pieces that grow and twist at a constant rate. Scale = 1 m.

A hurricane is a self-organizing spiral in the atmosphere, driven by the evaporation and condensation of sea water. Scale = 500 km = $5*10^5$ m.

A spiral galaxy is the largest natural spiral comprising hundreds of billions of stars. Scale = 100,000 ly = ~10^{20} m.





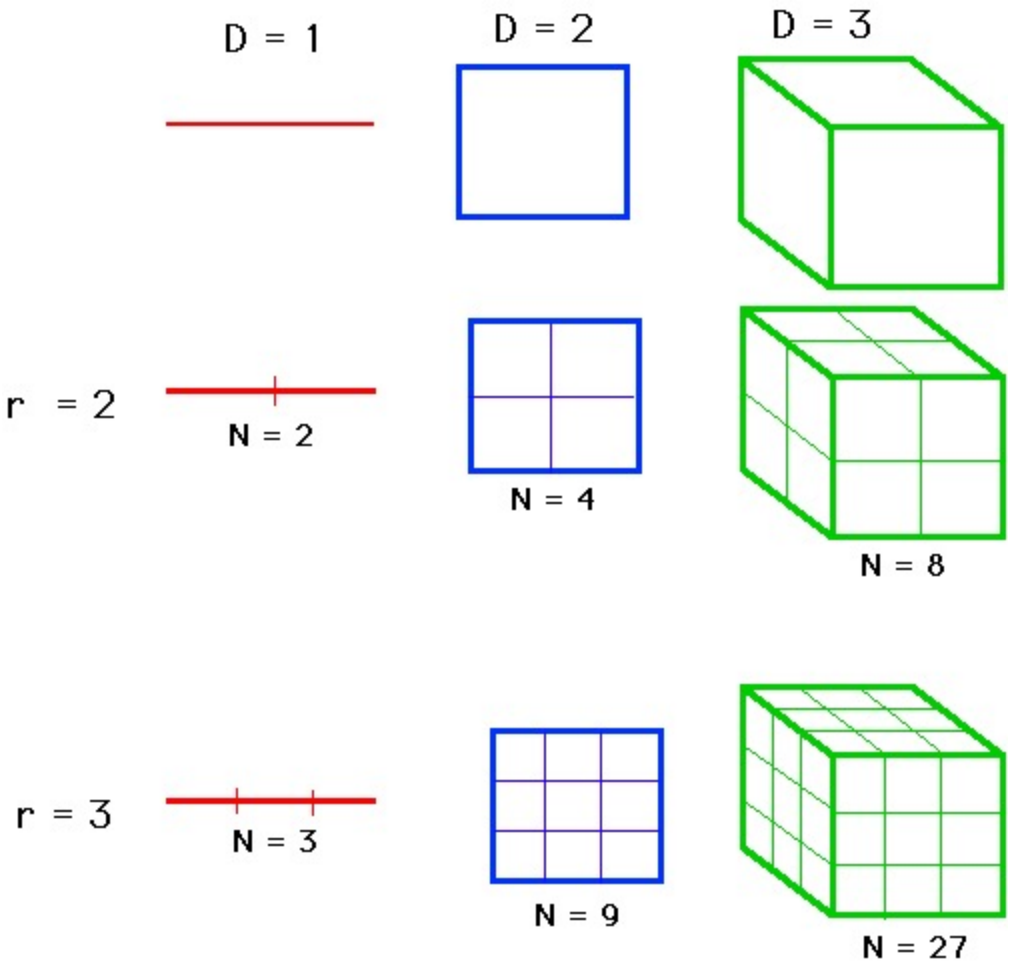
Fractal dimension

$$s^d = n$$

- d=fractal dimension
- S=scale factor
- n = number of copies

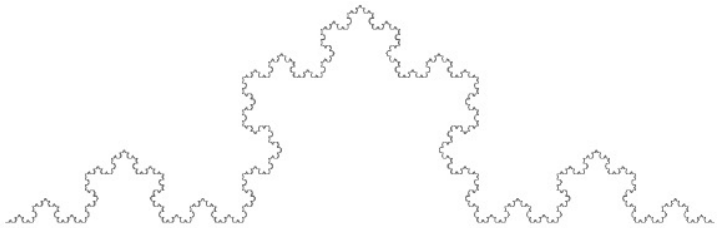
$$d = \log(n)/\log(s)$$

Fractal dimension

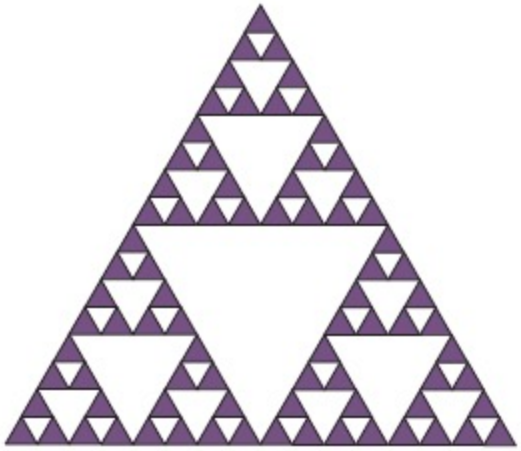


$$N = r^{D}$$

Fractal dimension for some shapes



d=log(4)/log(3)=1.26

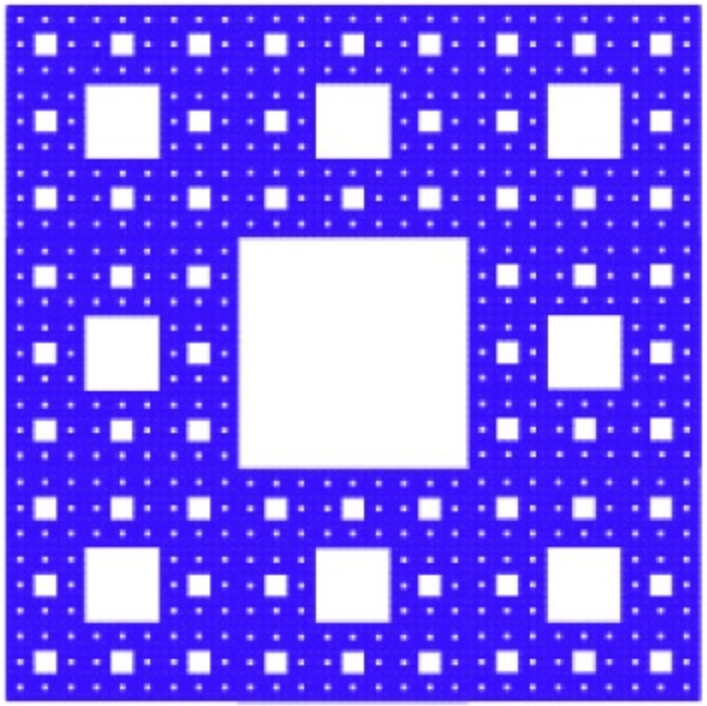


d=log(3)/log(2)=1.53

Create your own fractal

?

Serpinski's Carpet



Draw the first 4 steps which leads to such a shape?

What is the fractal dimension of the Serpinski's carpet?