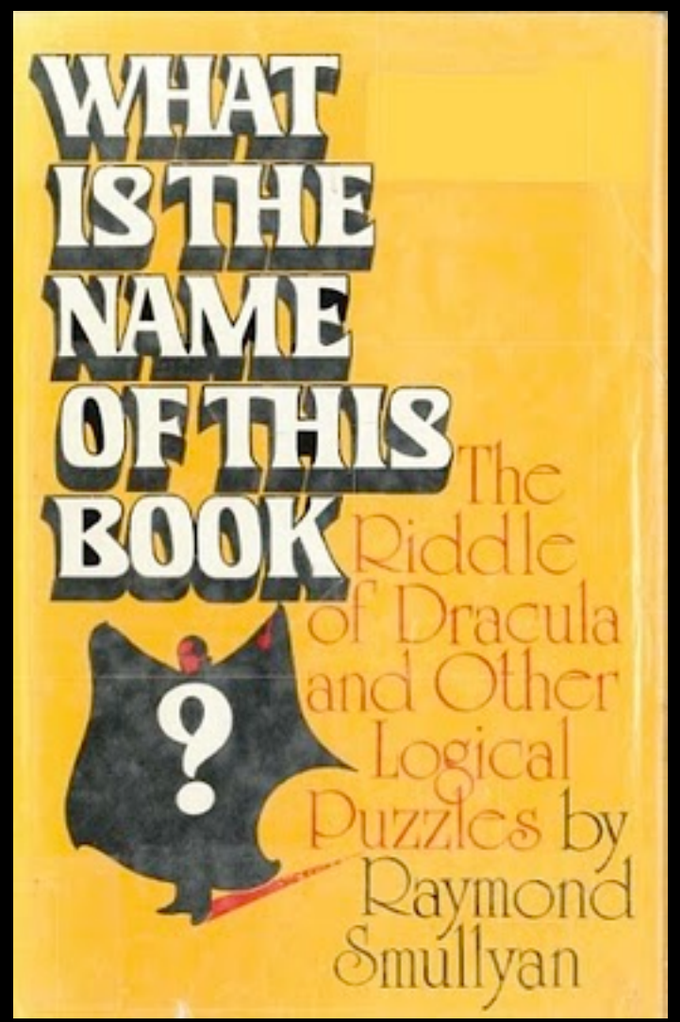
Recursion

Recursion

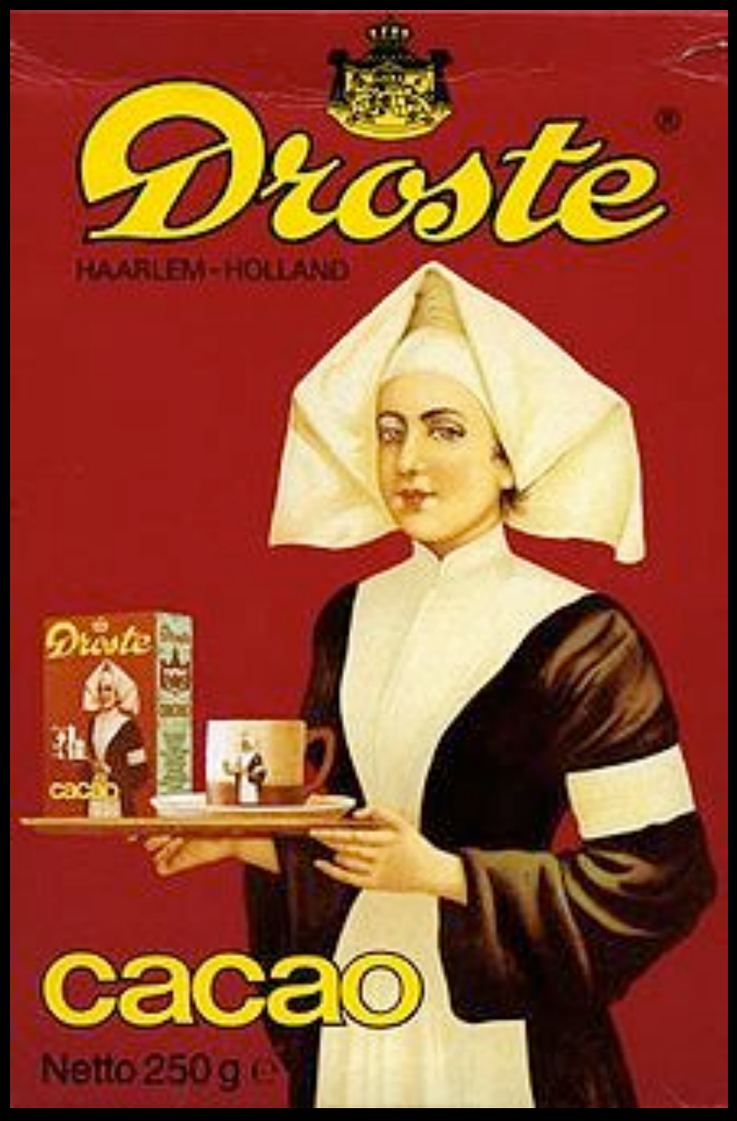
- Self-referencing definition
- Don’t forget the base-case!!

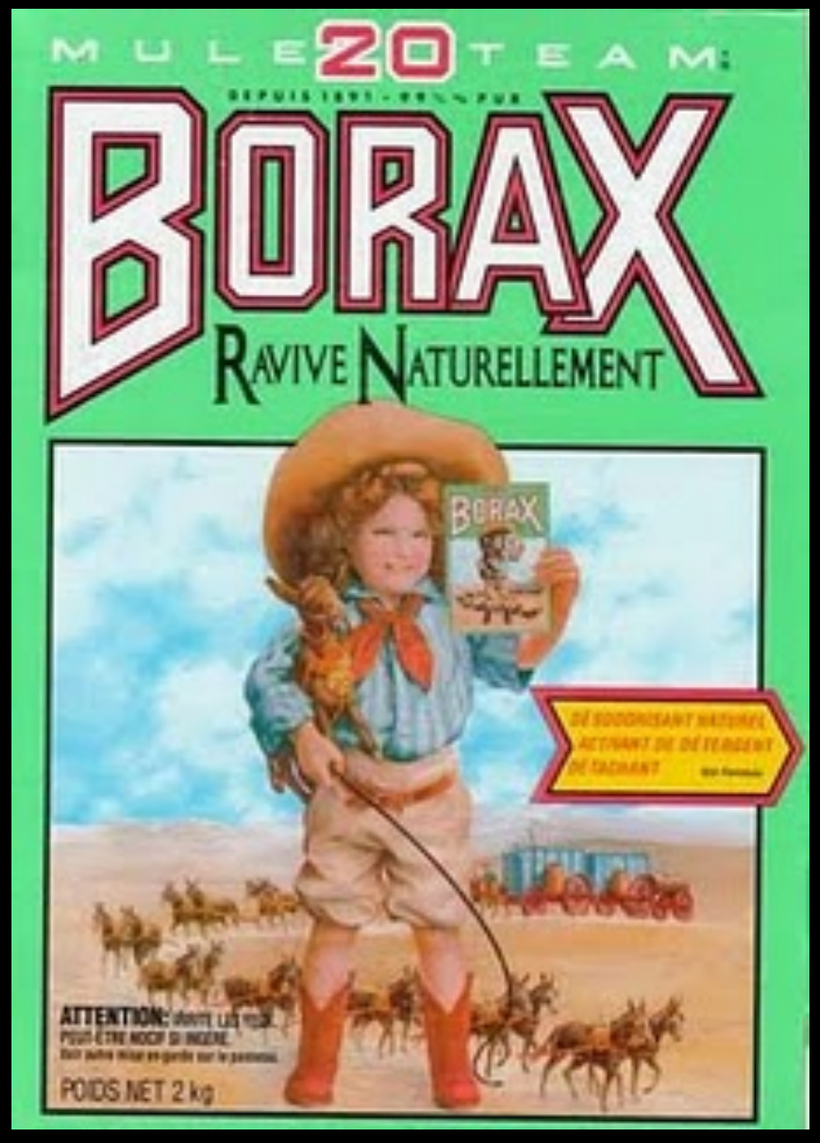
Examples

- In order to understand recursion, you must first understand recursion
- Try to Google recursion
- WINE: Wine Is Not an Emulator
- PHP: PHP Hypertext Preprocessor

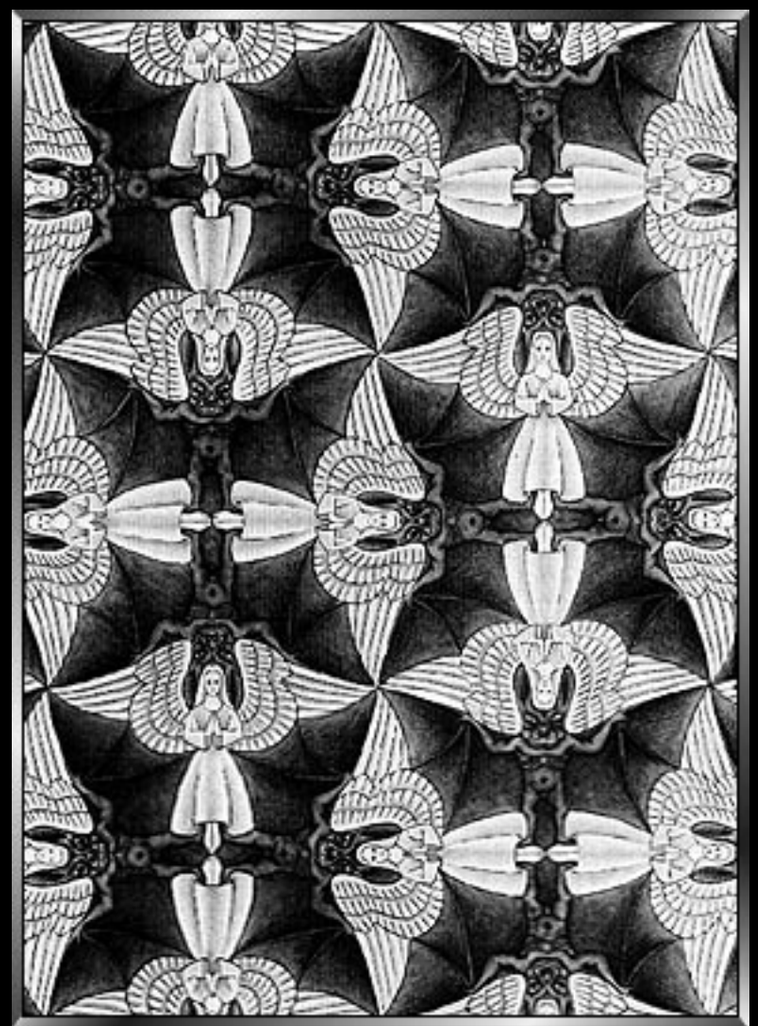


Droste Effect

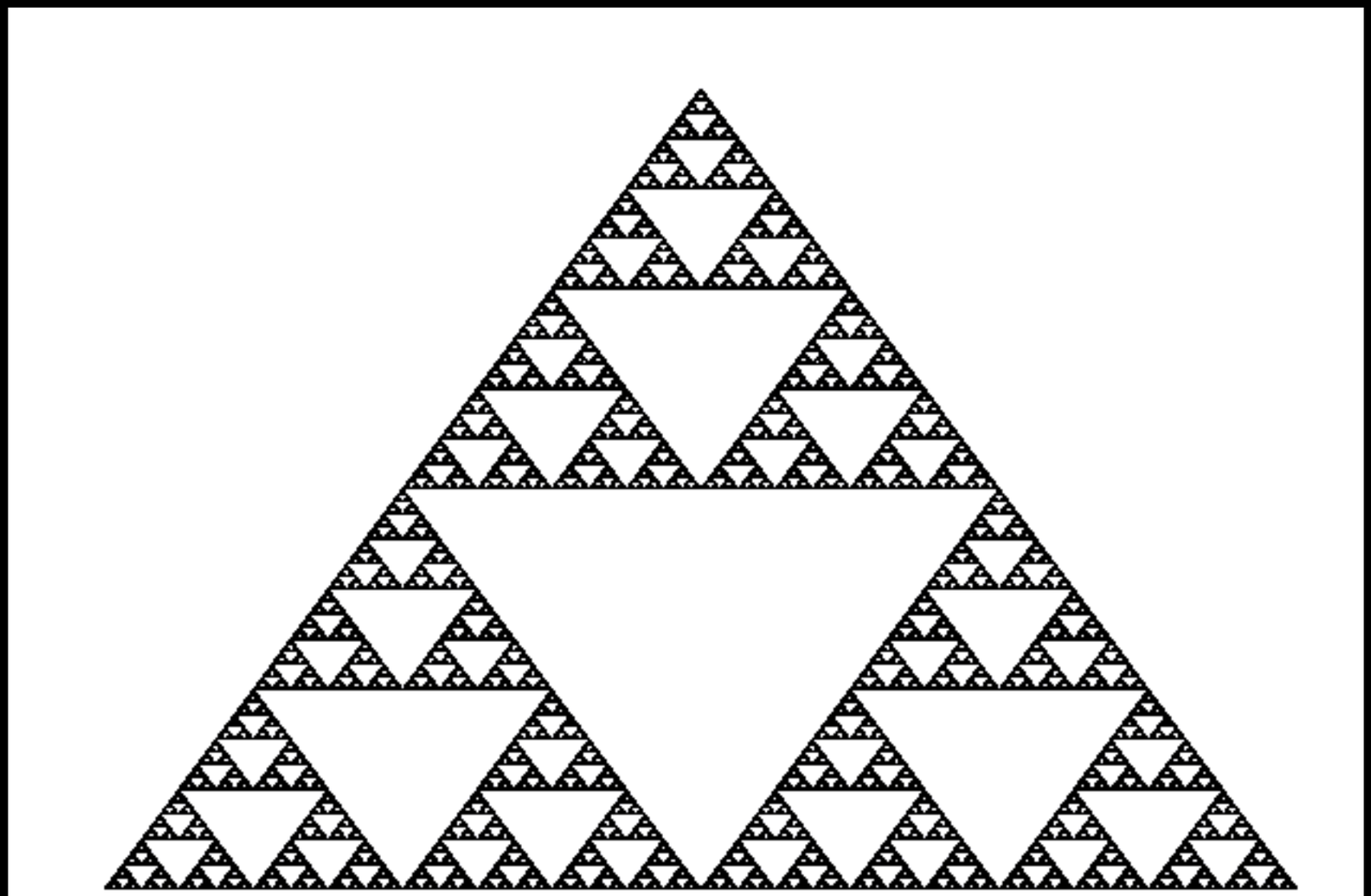




Recursive?



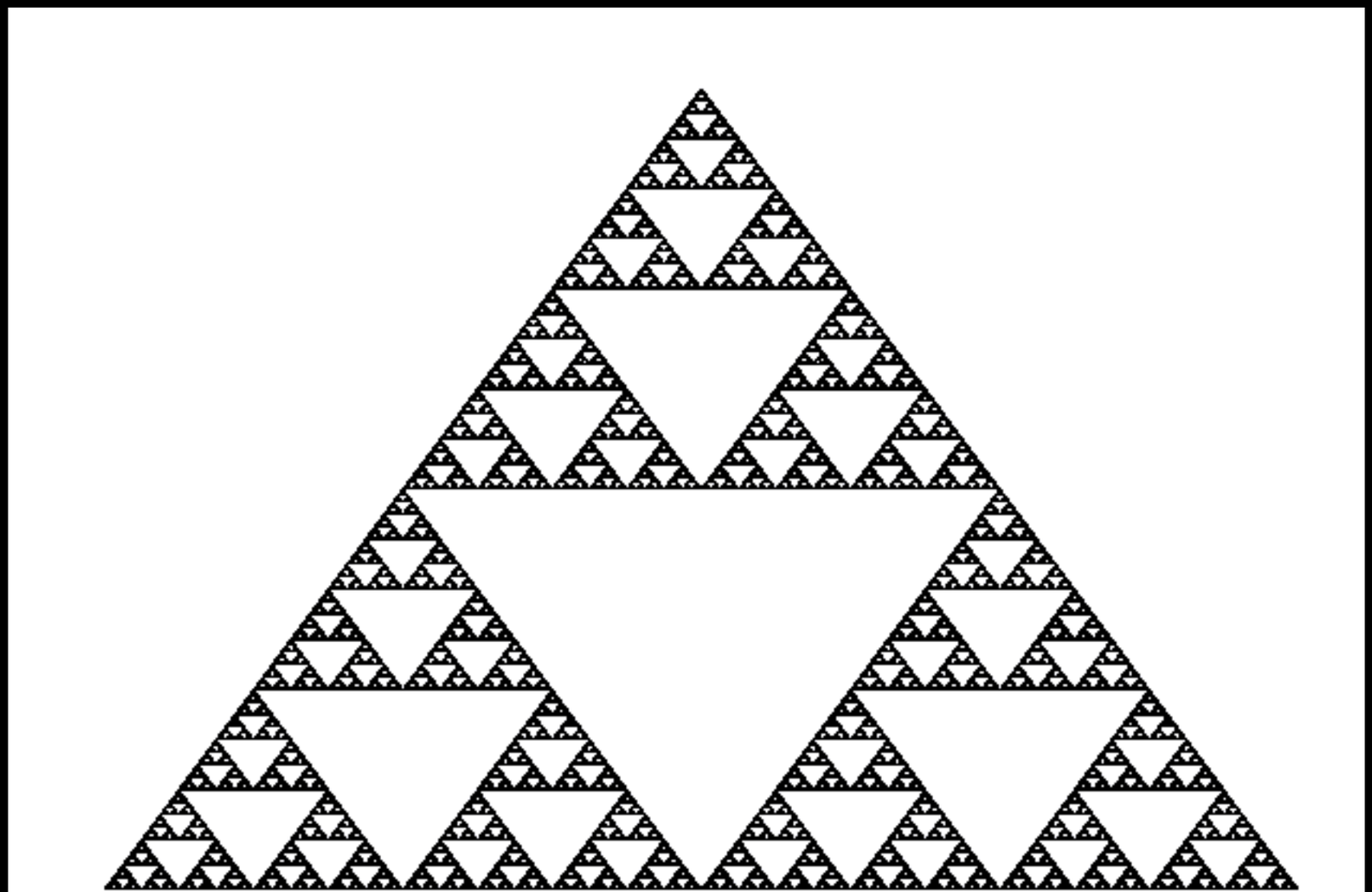
Recursively defined images



Sierpinski's Triangle

- Try to find a recursive definition for Sierpinski's Triangle
  - what is the base case?
  - where is the self reference happening?

Sierpinski's Triangle

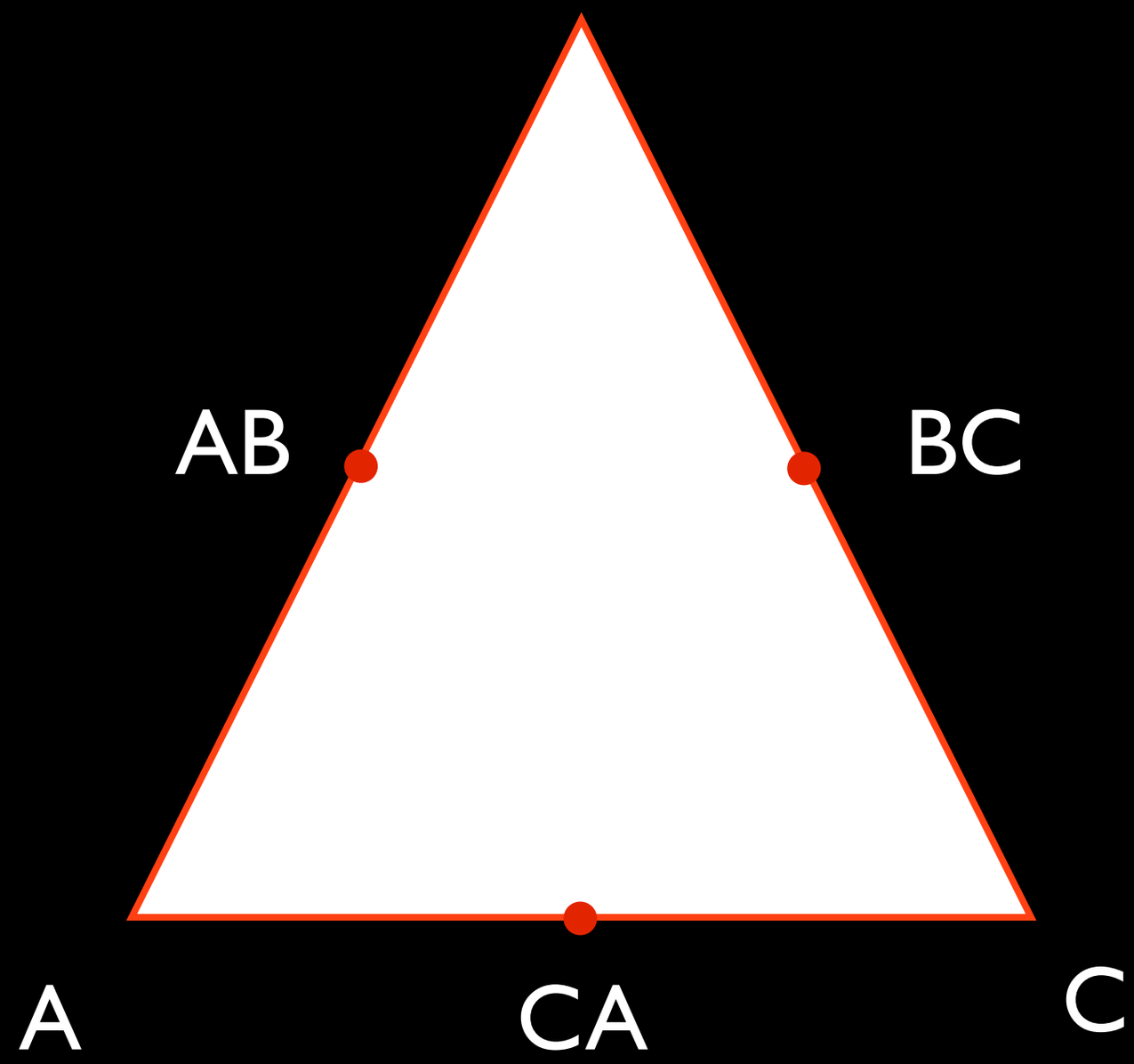


Sierpinski's Triangle

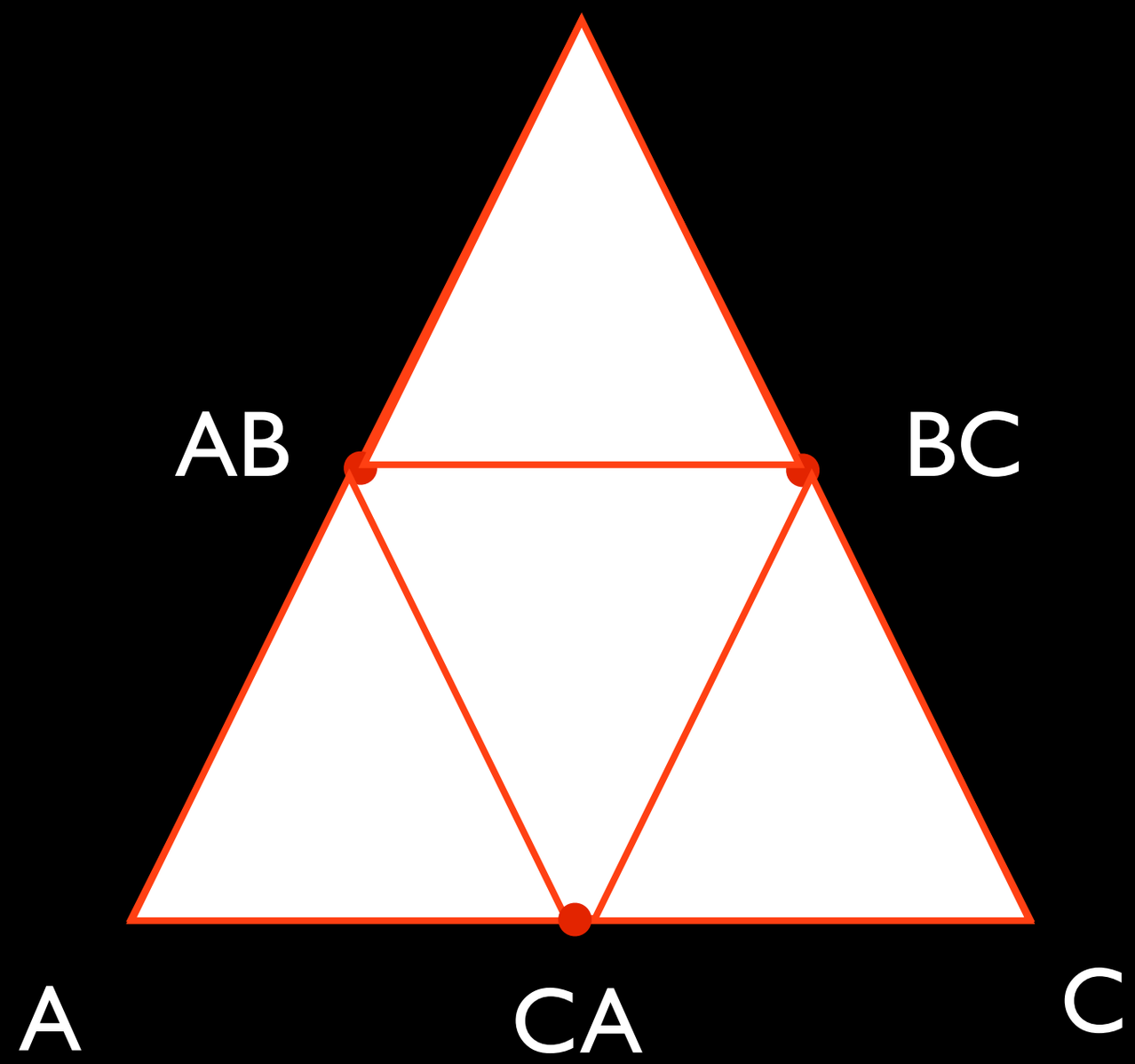
- Base Case: Points too close to draw a line between them
- Recursion:
  - For each edge in the triangle, find the midpoints, and use them to define 3 new triangles
  - Call Sierpinski on each one!

The idea...

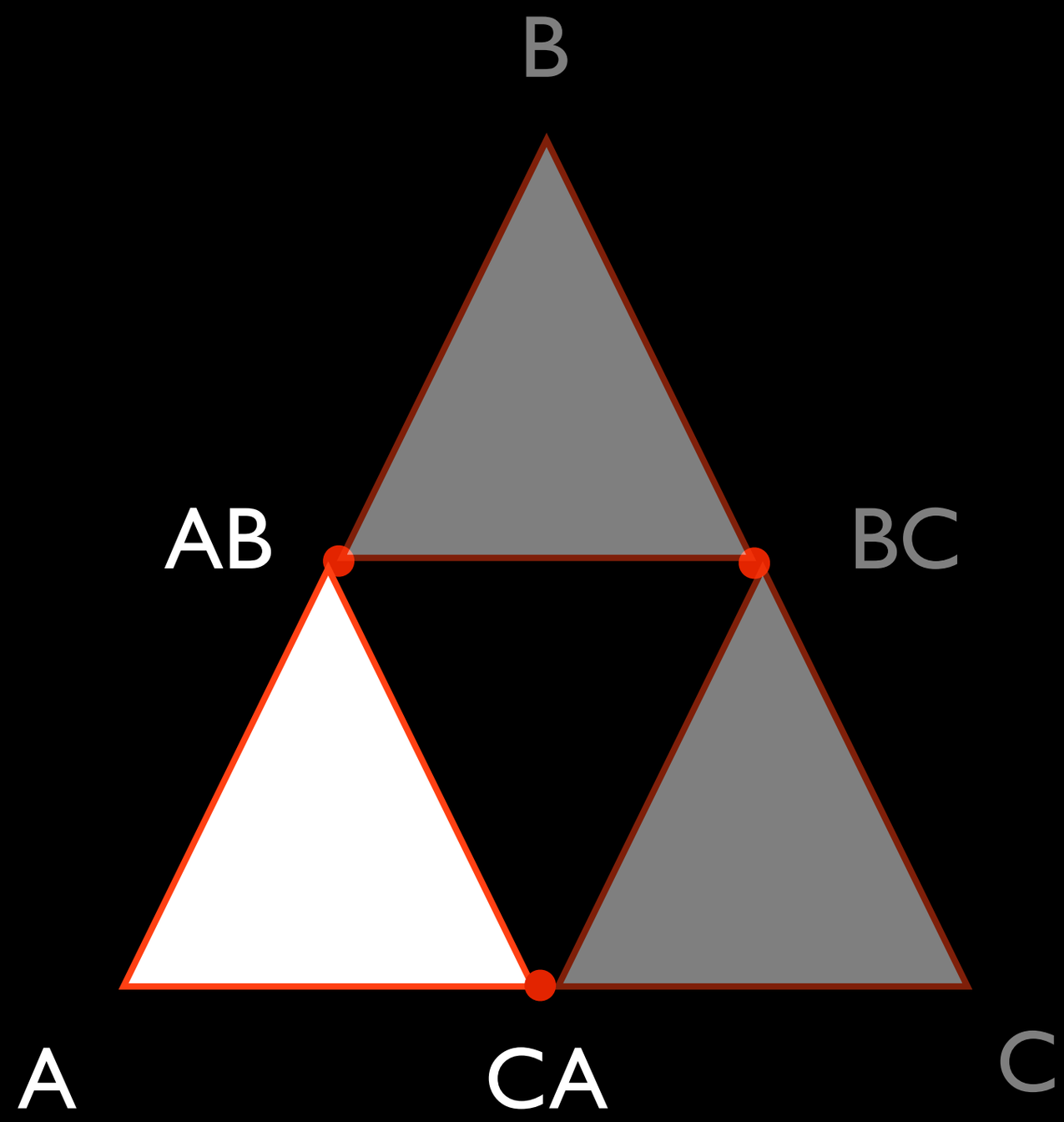
Find midpoints



Draw 3 triangles



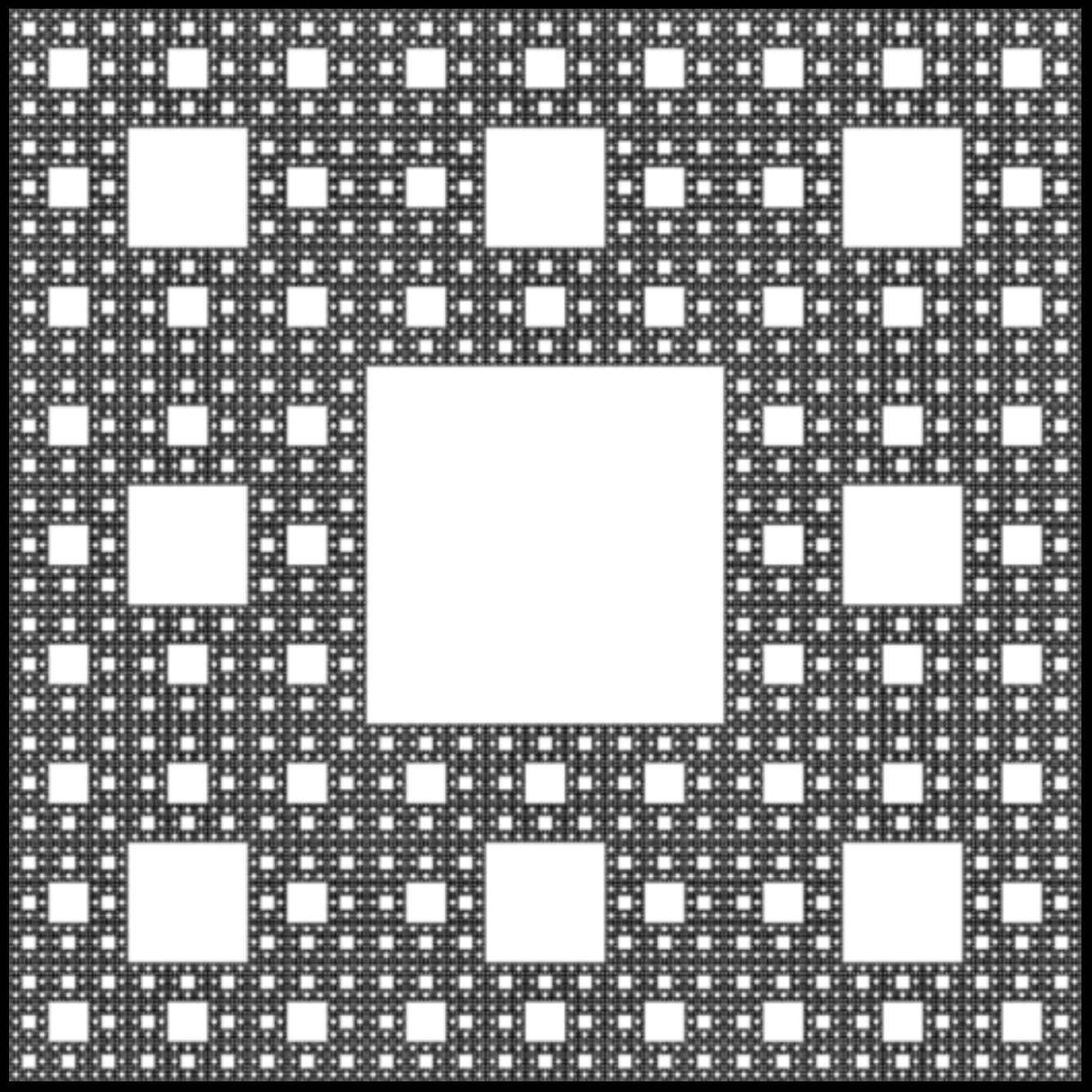
Do the same in smaller triangles



Sierpinski's Triangle

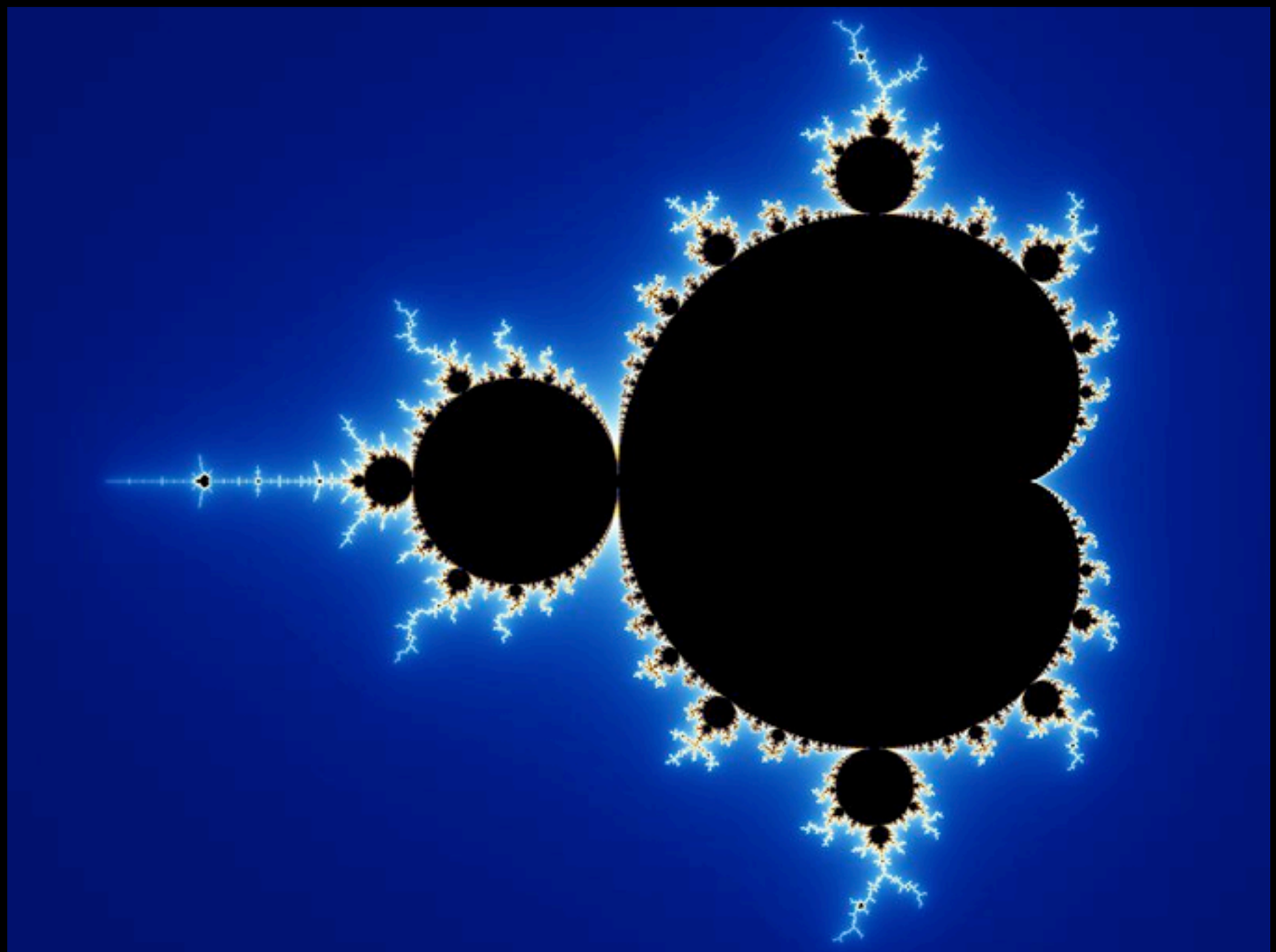
```
SIERPINSKI (A, B, C)

   IF points are too close, STOP
   ELSE{
     set AB to midpoint of A and B
     set BC to midpoint of B and C
     set CA to midpoint of C and A
     DRAWTRIANGLE(A, B, C)
     SIERPINSKI(A, AB, CA)
     SIERPINSKI(AB, B, BC)
     SIERPINSKI(CA, BC, C)
   }
```

Other recursive designs



http://en.wikipedia.org/wiki/File:Sierpinski_carpet.png

Mandelbrot Set



http://www.misterx.ca/Mandelbrot_Set---Thumb_Print_of_God.html

Fun interactive tools

- Mandelbrot explorer: http://math.bu.edu/DYSYS/explorer/
- L-System builder: kevs3d.co.uk/dev/lsystems/