Self-squaring fractals

Based on simple functions in complex space

Insert complex numbers (points) into a function

Apply function recursively, and analyze the behaviour.

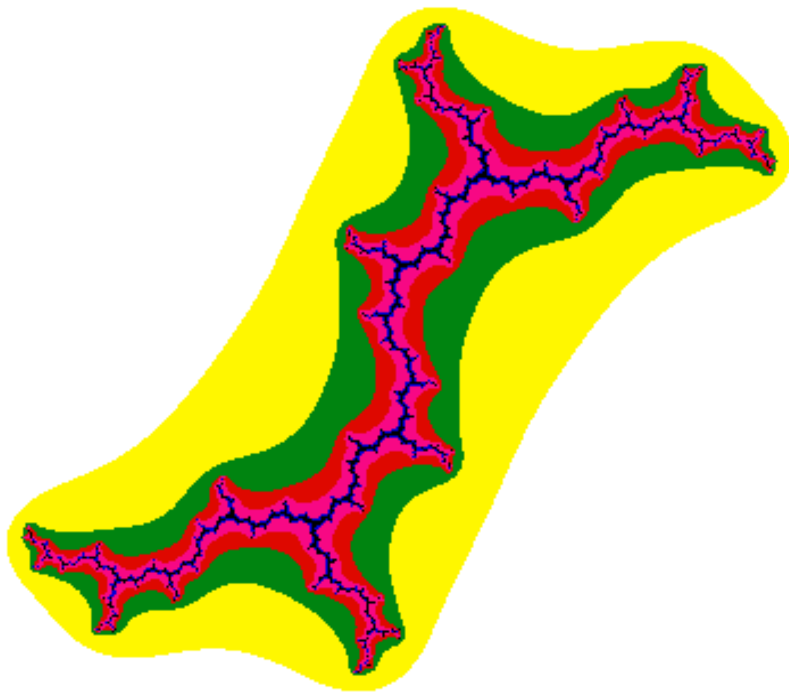
- **Diverge?**
- **Converge?**
- **Chaotic?**

Converge or chaotic: Does it keep within some limit in a number of iterations?

Self-squaring fractals

The Julia set

$$z_{k+1} = z_k^2 + \lambda$$



Julia set for $\lambda = (0, 1) = 0 + j$

The Julia set - Implementation

for y = miny to maxy
for x = minx to maxx
(zr, zi) = scaling of (x,y)

for i = 0 to maxiterations
$z = z^2 + \lambda$
if |z| > R then Leave

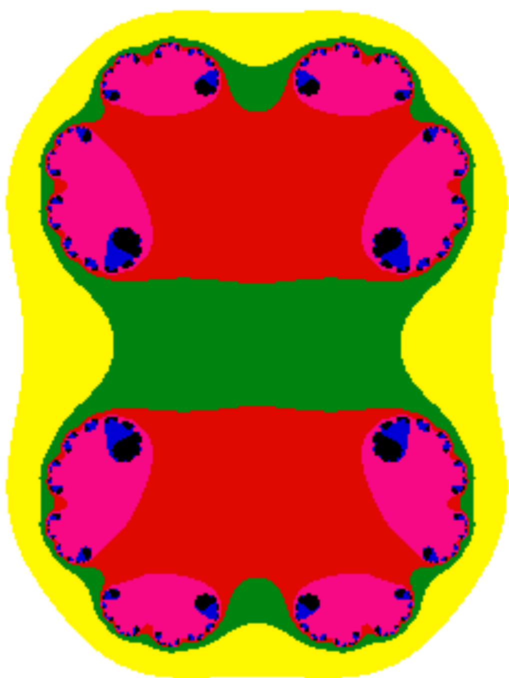
Draw pixel (x,y) (different colors for different i)

maxiterations ≈ 15
$R^2 \approx 10$

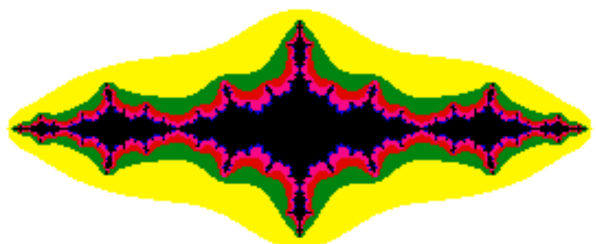
Other Julia sets

$$z_{k+1} = z_k^2 + \lambda$$

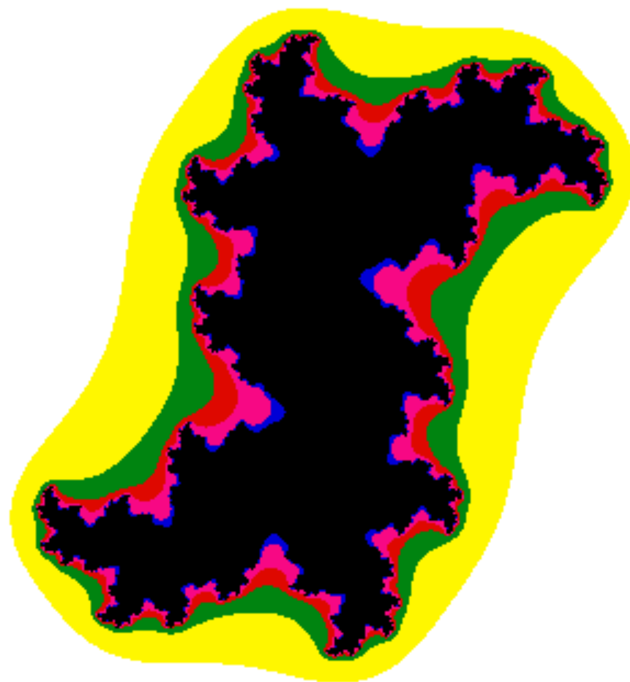
Other λ values



λ = (0.4, 0)



λ = (-1.3, 0)

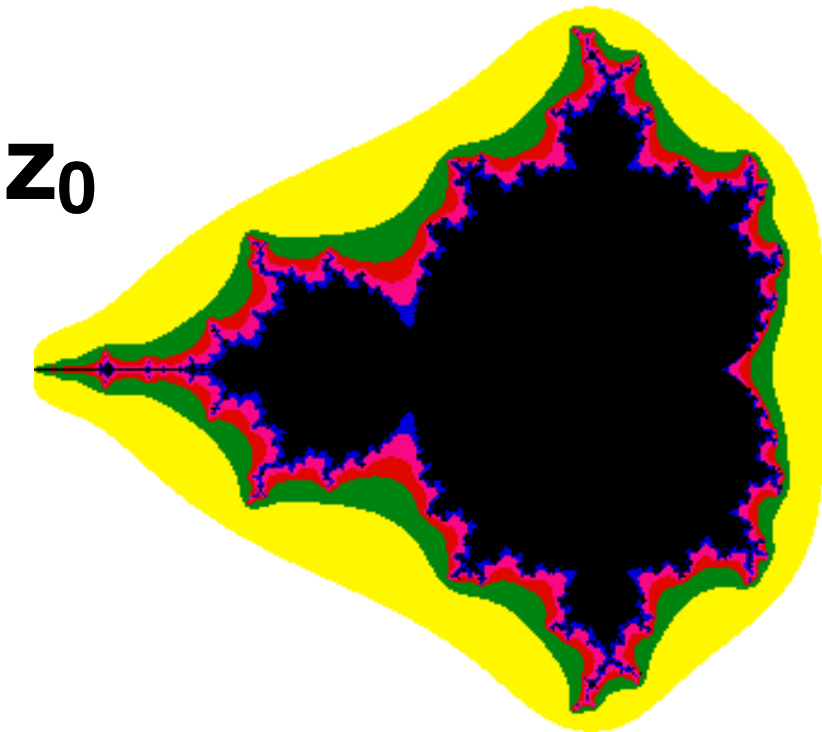


λ = (0.3, 0.5)

Self-squaring fractals

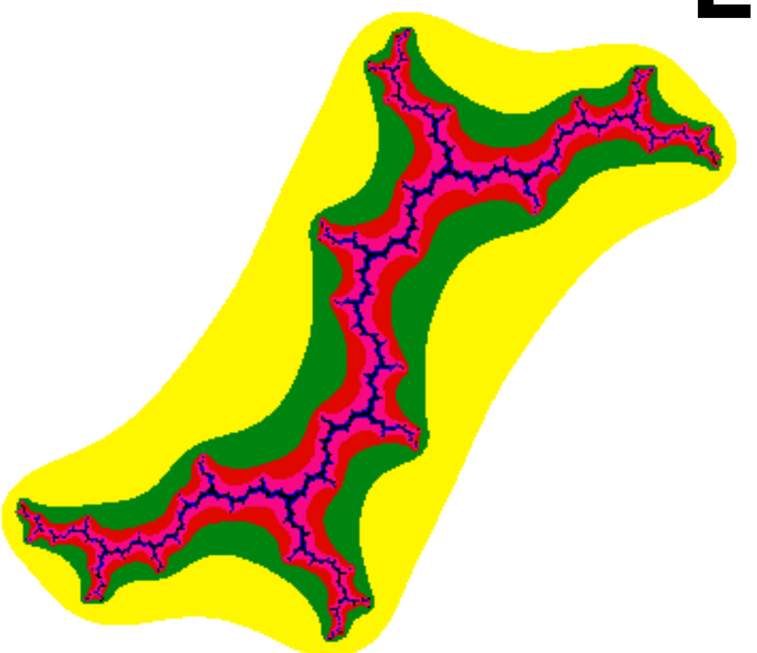
The Mandelbrot set

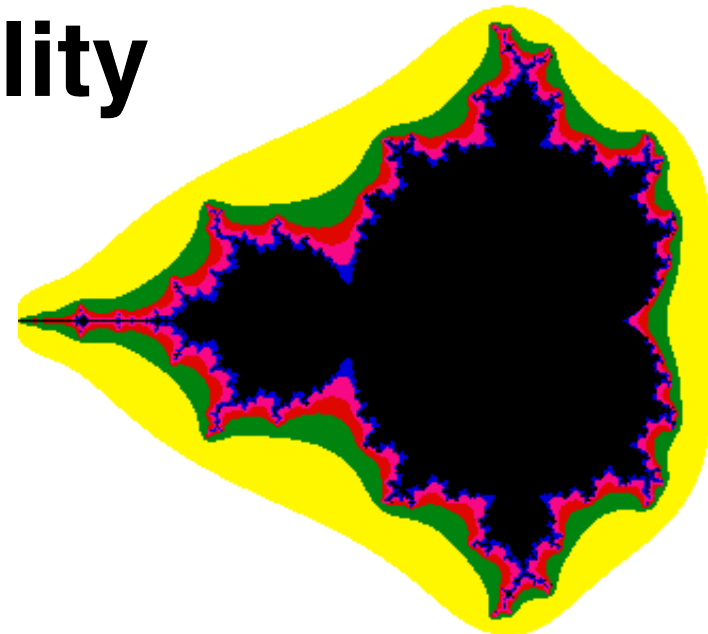
$$z_{k+1} = z_k^2 + z_0$$



Self-squaring fractals

- Beautiful
- Non-predictable
- Limited usability





Mathematical curiosity

Fractals, summary

1) Geometrically constructed fractals

Very useful for generating many kinds of natural objects

Allows design of complex models with arbitrary resolution

2) Self-squaring fractals (and other adventures in the complex plane)

Questionable practical usability

Hard to do planned designing