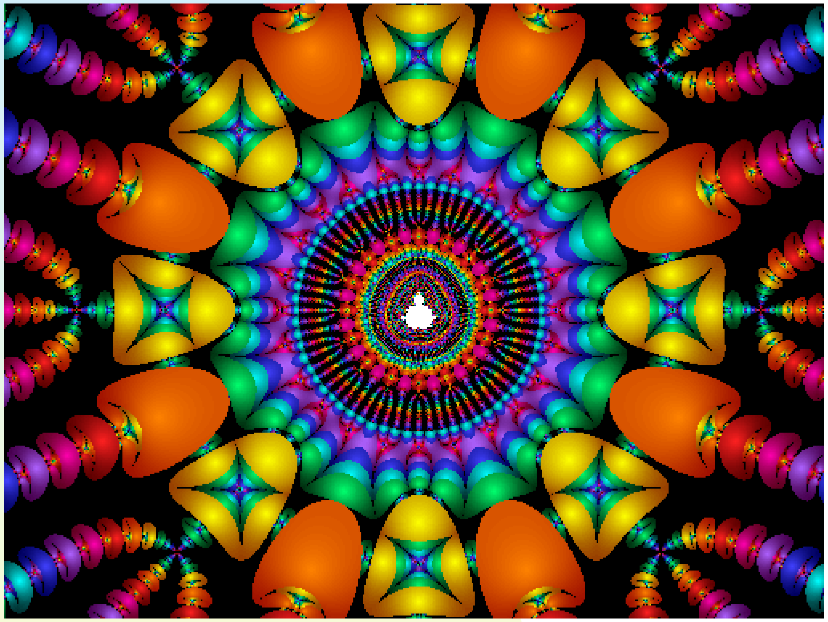
Session overview



- Mandelbrot set:
  - Map of Julia sets
  - Decorations
- Julia sets of transcendental functions

- Thursday class TBA
- Adam and Andrew each presenting Friday.

Map of Julia Sets

- http://upload.wikimedia.org/wikipedia/commons/8/8e/725_Julia_sets.png

How many decorations?

- Let’s see if we’ve identified all the decorations in the Mandelbrot set
- See solution

Transcendental functions I: $c \sin(z)$

Write as $(c_x + ic_y) \sin(z_x + iz_y)$

Derive

Transcendental functions II: $c \cos(z)$

$(c_x + ic_y) \cos(z_x + iz_y) =$

$(c_x + ic_y) (\cos(z_x) \cos(iz_y) - \sin(z_x) \sin(iz_y)) =$

$(c_x + ic_y) (\cos(z_x) \cosh(z_y) - i \sin(z_x) \sinh(z_y)) =$

$(c_x \cos(z_x) \cosh(z_y) + c_y \sin(z_x) \sinh(z_y)) + i(c_y \cos(z_x) \cosh(z_y) - c_x \sin(z_x) \sinh(z_y))$

Transcendental functions III: ce^z

Derivation on board

Computer program

- The code to generate the transcendental Julia sets is in **`ColorJuliaSets.cpp`**
- `Try 25 iterations:`
  - `c*sin(z): c=1,-2π<=x,y<=2π`
  - `c*cos(z): c=1,-2π<=x,y<=2π`
- `30 iterations of ce^z:`
  - $c = 1/e = 0.3678794417$
  - $1.0 \le x \le 9.0$
  - $-2 \le y \le 2$

Summary

- Julia sets are not just defined for

  $f(z)= z^2 + c$
- They can be defined on many other functions, e.g., polynomials, trig functions, logs!
- Julia himself was originally interested in the properties of

  $z^4 + z^3/(z-1) + z^2/(z^3 + 4z^2 + 5) + c$.
- Experiment with another function now.