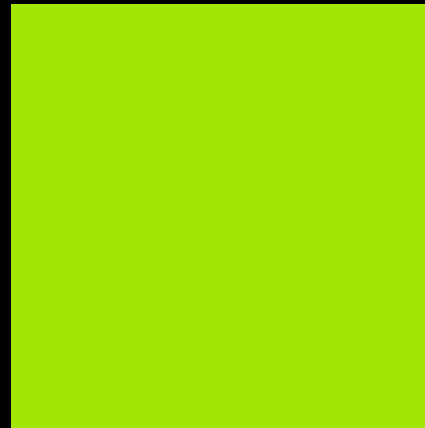
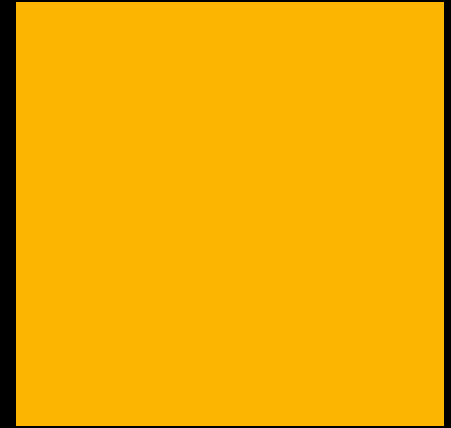
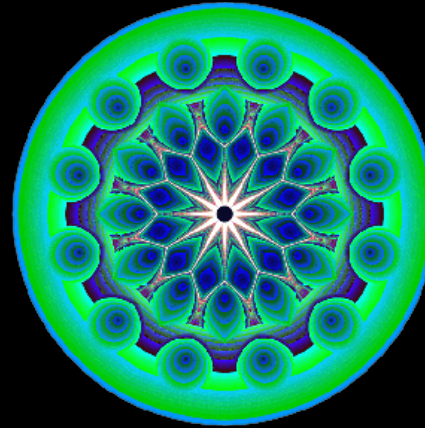




Polynomiography

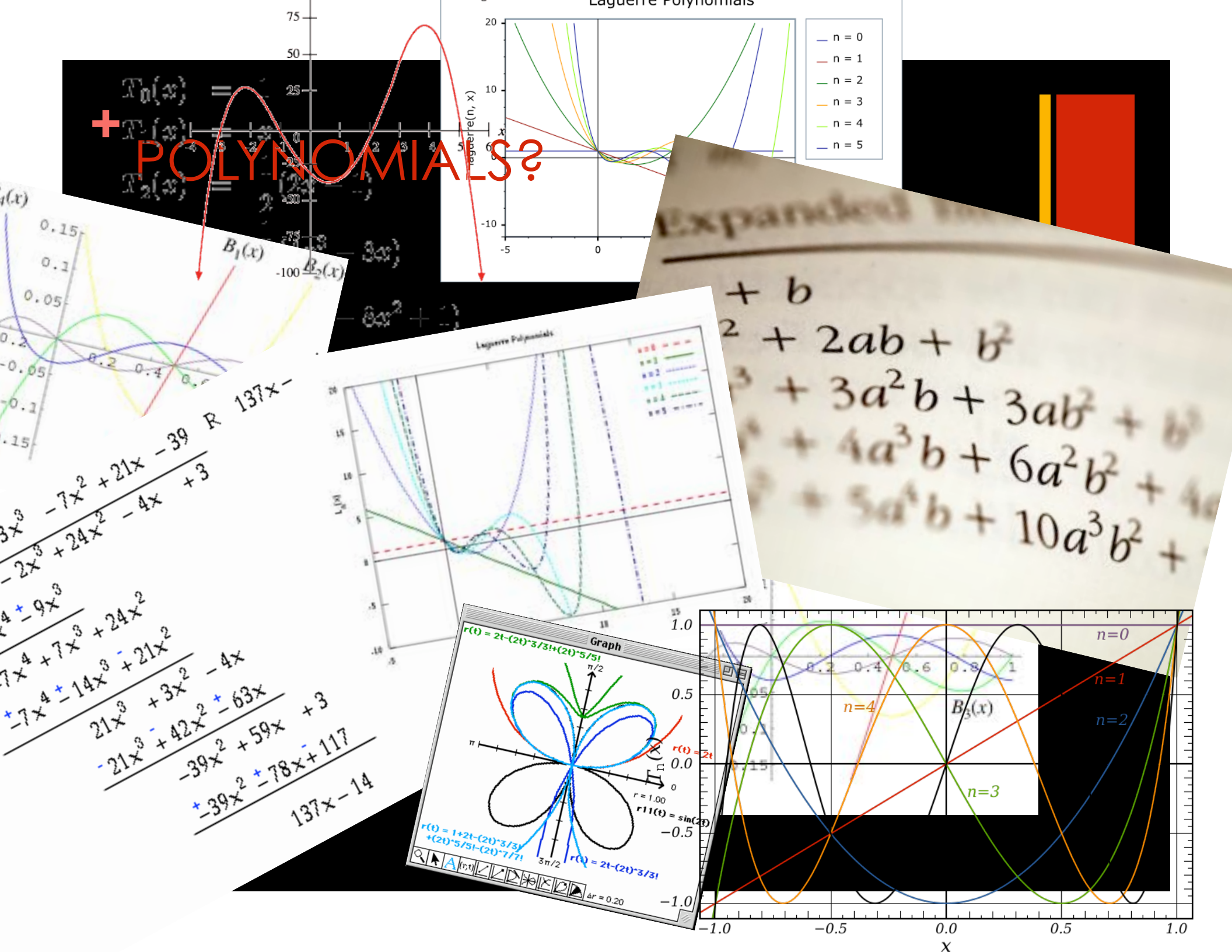
Presented By

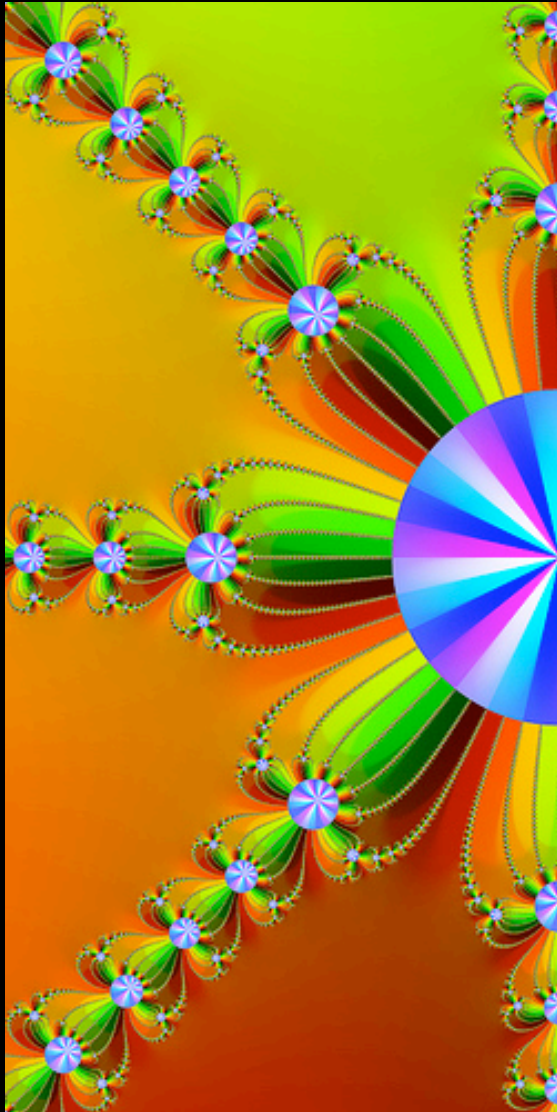
Mary Katherine Battles

Mentored By

Bahman Kalantari

+ POLYNOMIALS?





What is Pol-y-no-mi-o-graphy?

- “the art and science of visualization in approximation of the zeros of complex polynomials, via fractal and non-fractal images created using the mathematical convergence properties of iteration functions.”

- Bahman Kalantari

A.
K.
A.



- Graphing of special Polynomials in an unconventional way
- Creating beautiful images through the use of precise mathematical algorithms
- Utilizing complex (and simple) roots of real and imaginary components
- Shapes like Abstract/Minimalism
- Colors like fauvism
- Akin to patterns, composition, and elegance of Islamic, Oriental, and French designs
- Art in the Math and Sciences
- Math and Science in the Arts



In Its Most Basic Form

Polynomials

$$p(z) = a_n z^n + a_{n-1} z^{n-1} + \cdots + a_1 z + a_0$$

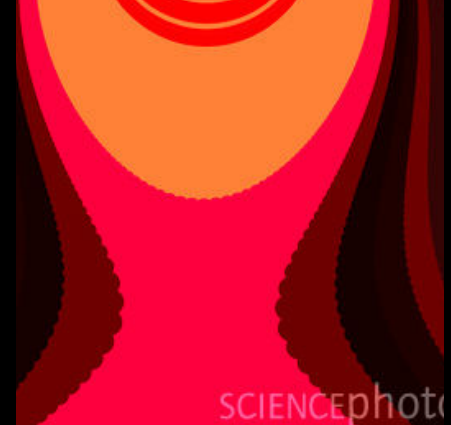
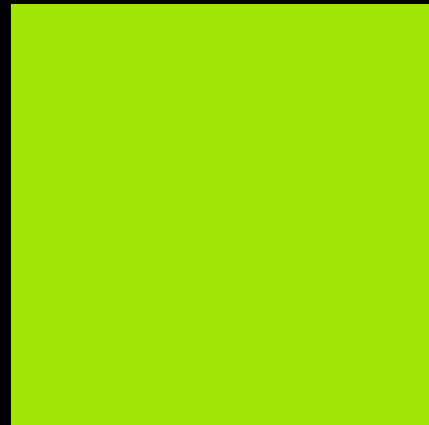
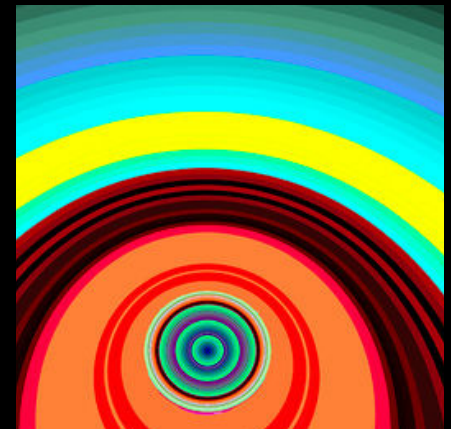
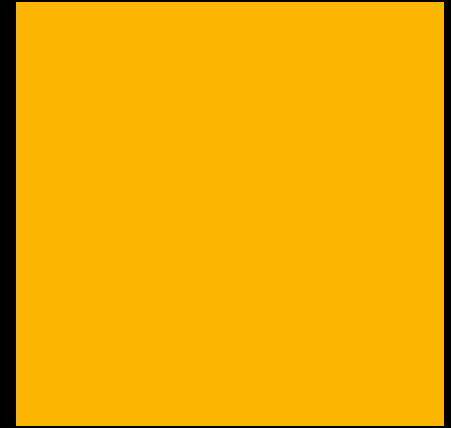
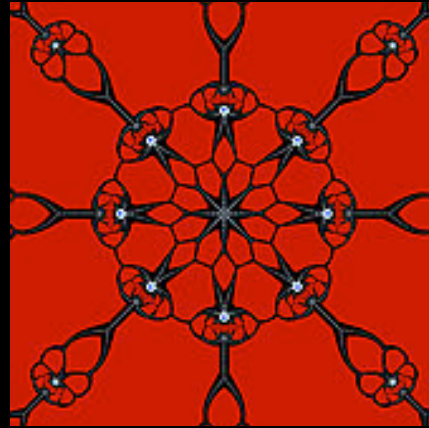
Use of Complex Numbers

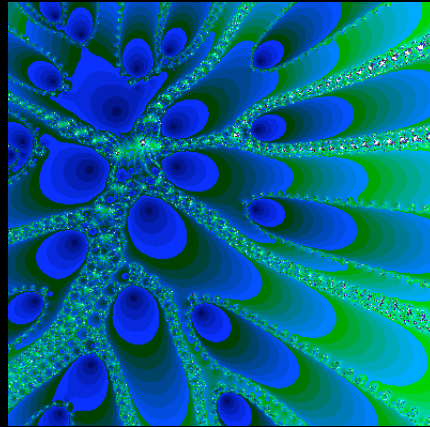
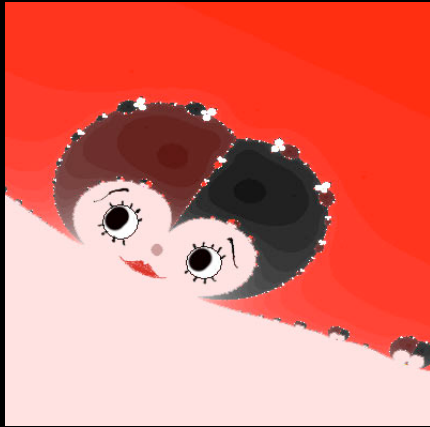
Simply a point in the Euclidean Plane
or Complex Plane

With ordered pair (a,b)

Becoming $a + ib$

Using Modulus to find ascension and
descension





Modulus

- Gives Magnitude of Complex Number
- Tells How far Point is From Origin

- In form $a + ib$ the modulus is

$$|a + ib| = \sqrt{a^2 + b^2} = F(x, y)$$

- Where “a” and “b” are the real + components

- Ex: $P(z) = z^2 - 1$, where $z = x + iy$

- $|P(z)| = |z^2 - 1|$

- $|(x + iy)^2 - 1|$

- $|x^2 + 2ixy - y^2 - 1|$

- $x^2 - y^2 - 1$ is “a”

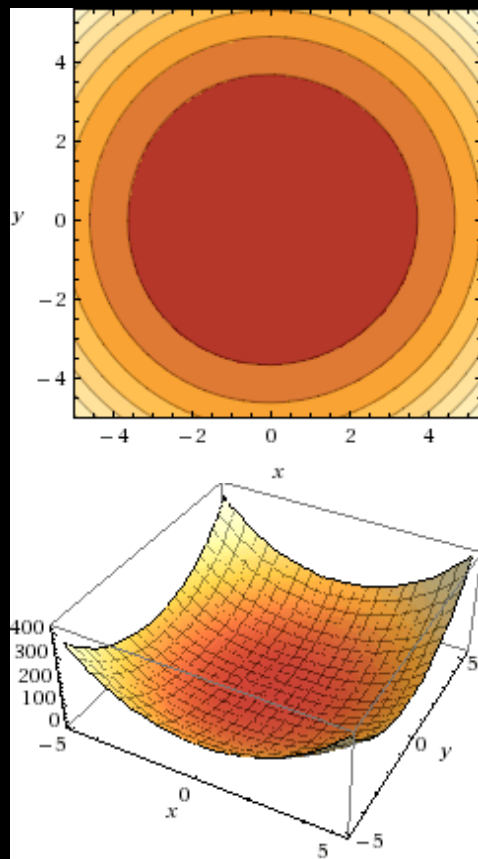
- $2xy$ is “b”

- $|(x^2 - y^2 - 1) + i2xy|$

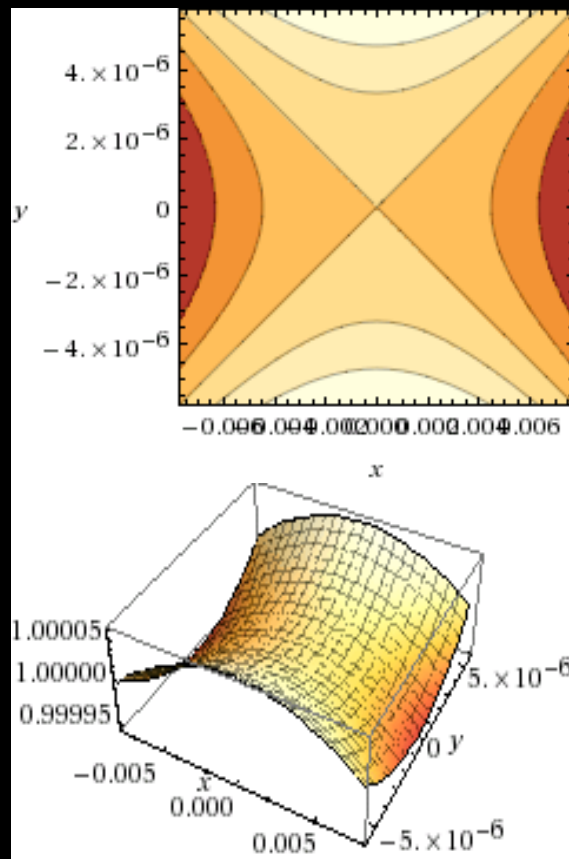
- $|P(z)| = \sqrt{(x^2 - y^2 - 1)^2 + (2xy)^2}$

+ Modulus of Complex Numbers

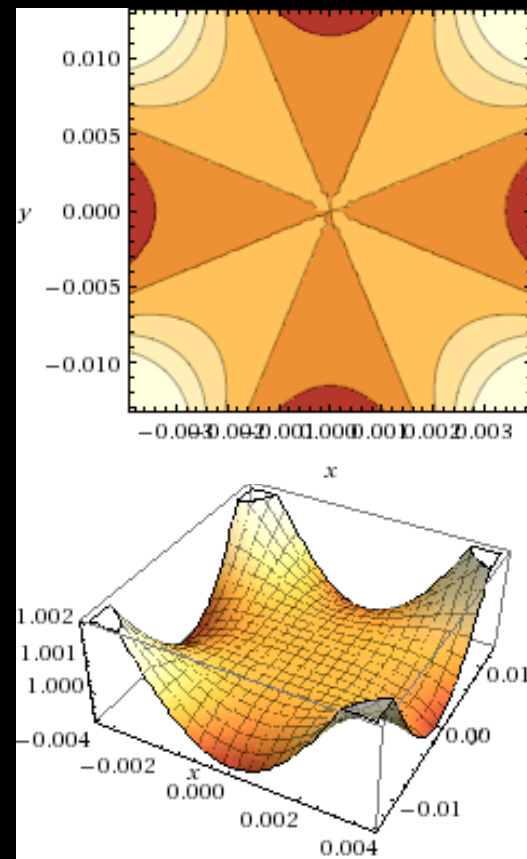
$$|(x + iy)^3 - 1|$$



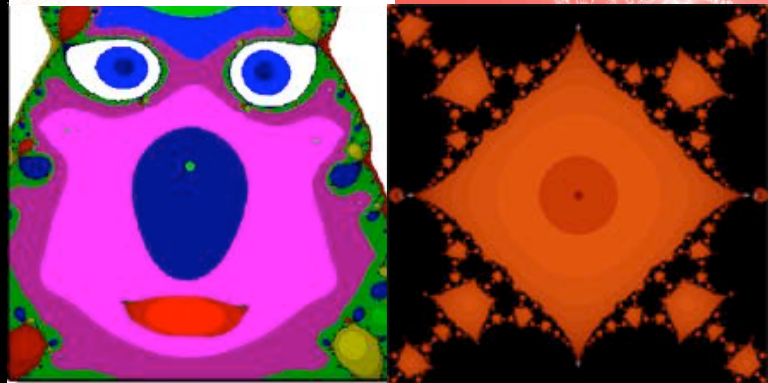
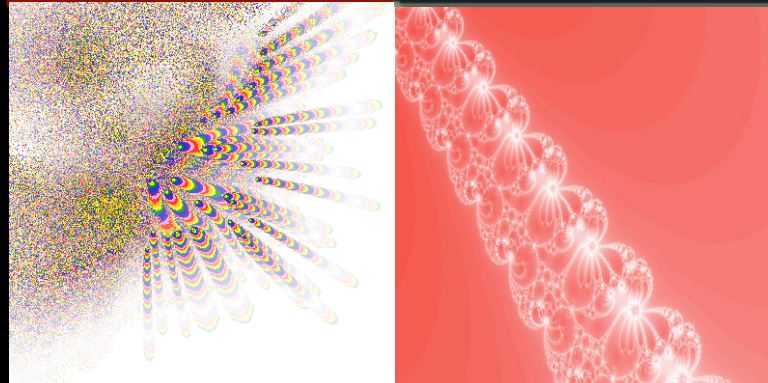
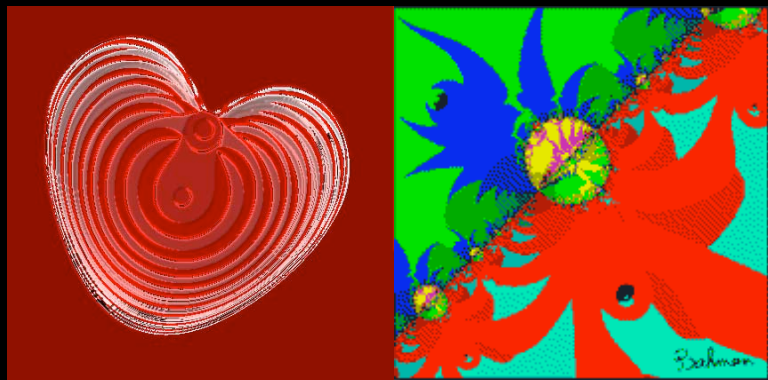
$$|(x + 1343iy)^2 - 1|$$



$$|(44x + 13iy)^4 - 1|$$



+ The Mission



- How can Polynomiography be translated to physical art pieces?
- While on the screen it has limited depth, how do their modulus influence their depth in drawings?
- Can these graphs be organized in respect to:
 - Roots
 - Coefficients
 - Degrees
- In what ways do these aspects affect the graph?
- To what extent does symmetry come into play?

