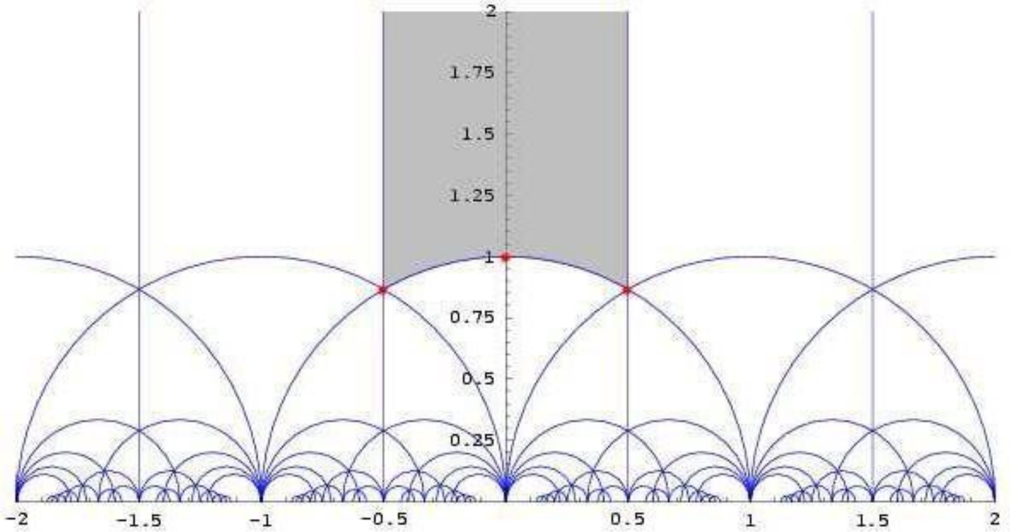
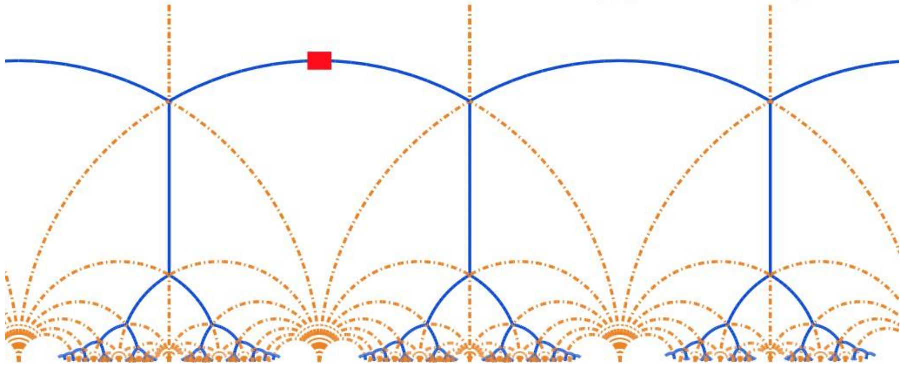
Math club designs

Fundamental domains

- used in geometry to represent a shape that, when repeated in certain ways, fills up a bigger space without any overlaps or gaps.
- Imagine a tile on the floor: its fundamental domain is the smallest part of the tile that, when repeated, covers the entire floor without leaving any spaces in between.
- fundamental domains are important for studying symmetry, tiling, and understanding shapes in different dimensions.
- They're like the building blocks that help us explore and understand how shapes fit together in various patterns.

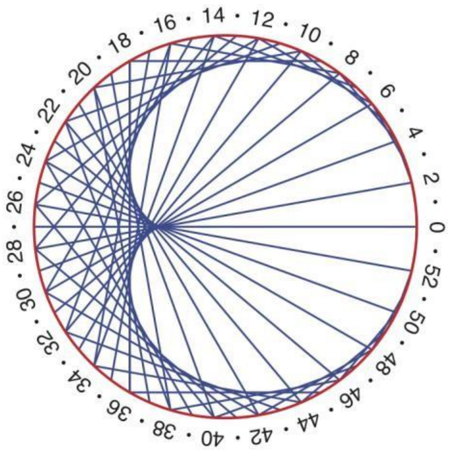


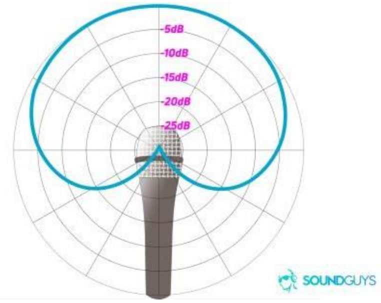
Fundamental Domains on the Upper Half-plane

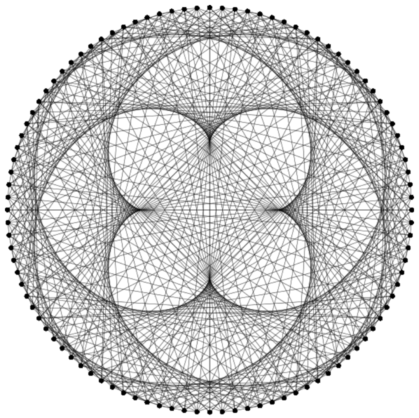


cardiods

- They are a specific form of the mathematical shape called an epitrochoid.
- **r = a ± cosθ** i
- Mathematically, they're defined as the set of points traced by a fixed point on a circle as that circle rolls around another fixed circle.
- Cardioids have applications in physics, engineering, and various areas of mathematics, especially in geometry and calculus.
- They appear in different natural phenomena and are used in designing curves for specific functions or aesthetic purposes.





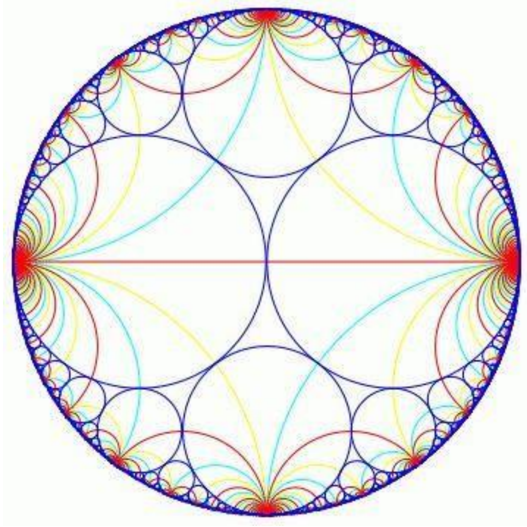


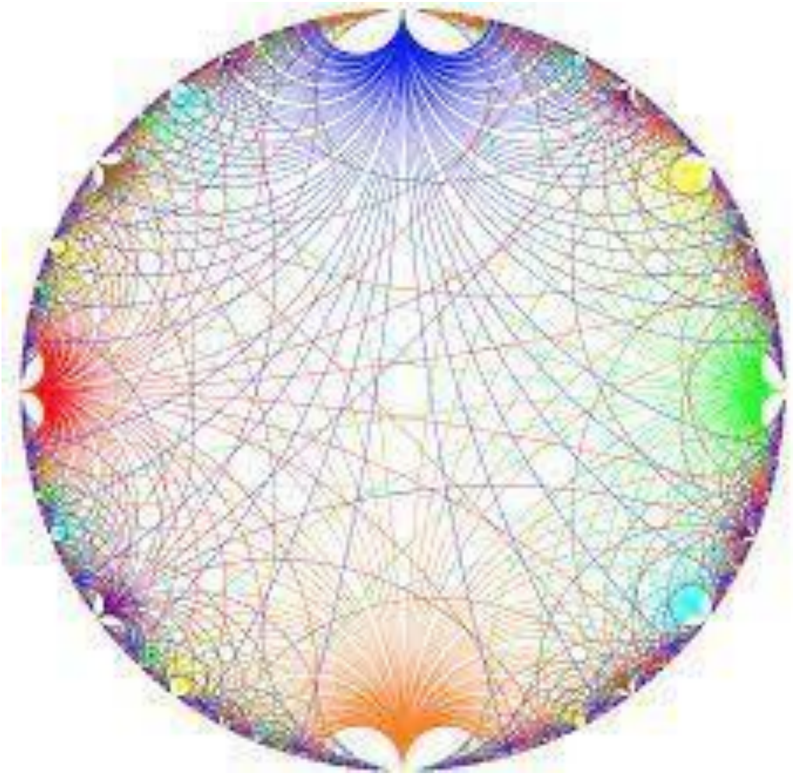
Tokarsky’s unillumanable room

- Tarski's unilluminable room challenges the idea that any enclosed space can be entirely lit.
- It envisions a room where, regardless of light placement or quantity, certain areas always remain in shadow.
- This concept explores limitations in illuminating certain geometric spaces.
- It highlights the complexities of

Farey diagrams

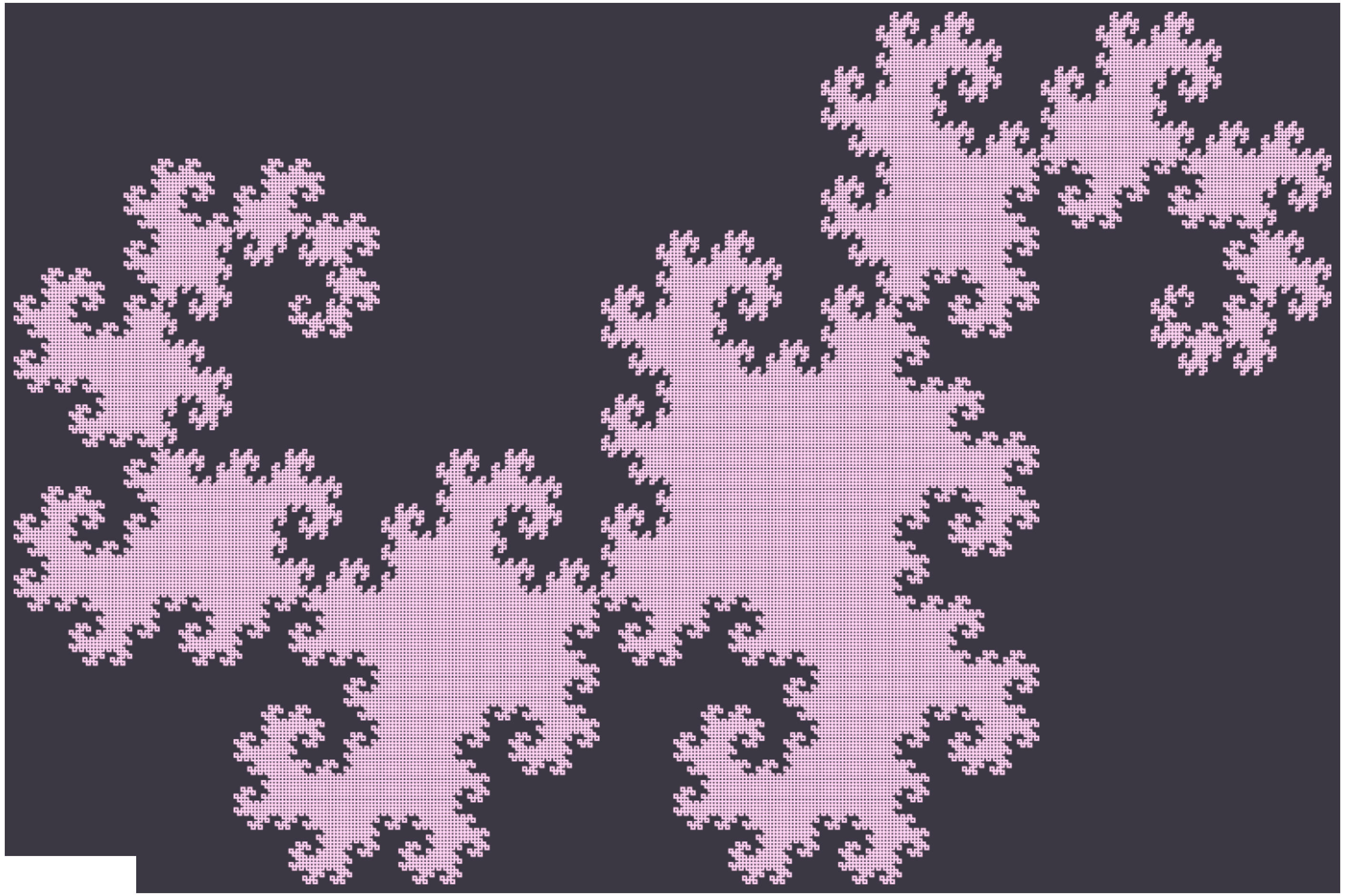
- Farey diagrams depict fractions between 0 and 1 in order from smallest to largest denominators.
- They show all irreducible fractions within a given range.
- Each point represents a fraction, illustrating their relative sizes and relationships.
- Useful in number theory, studying approximations, and understanding rational numbers' patterns.





Dragon curve

Epic cool very awesome fractal



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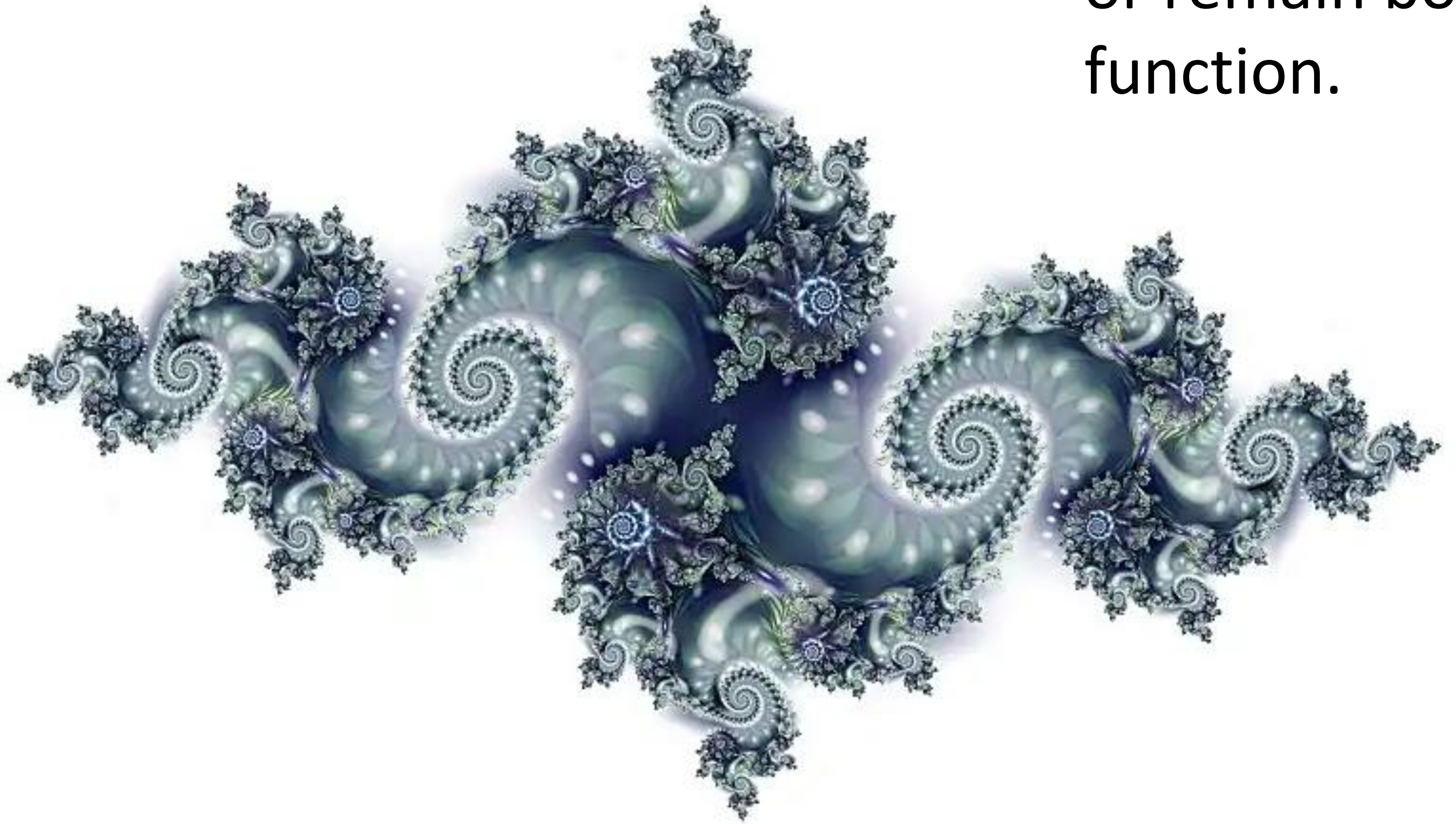
Julia sets

Another epic cool fractal



The Julia set is generated by iterating a complex function f(z) = z^2 + c, where z is a complex number and c is a constant complex number. The Julia set is the boundary between points that either escape to infinity or remain bounded under iteration of this function.

The Mandelbrot set, on the other hand, is a set of complex numbers
c for which the iterative process (z) = z^2 + c does not escape to infinity when iterated from z=0.

Barnsley fern

Another fractal

$$f_1(P) = \begin{bmatrix} 0 & 0 \\ 0 & 0.16 \end{bmatrix} P + \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

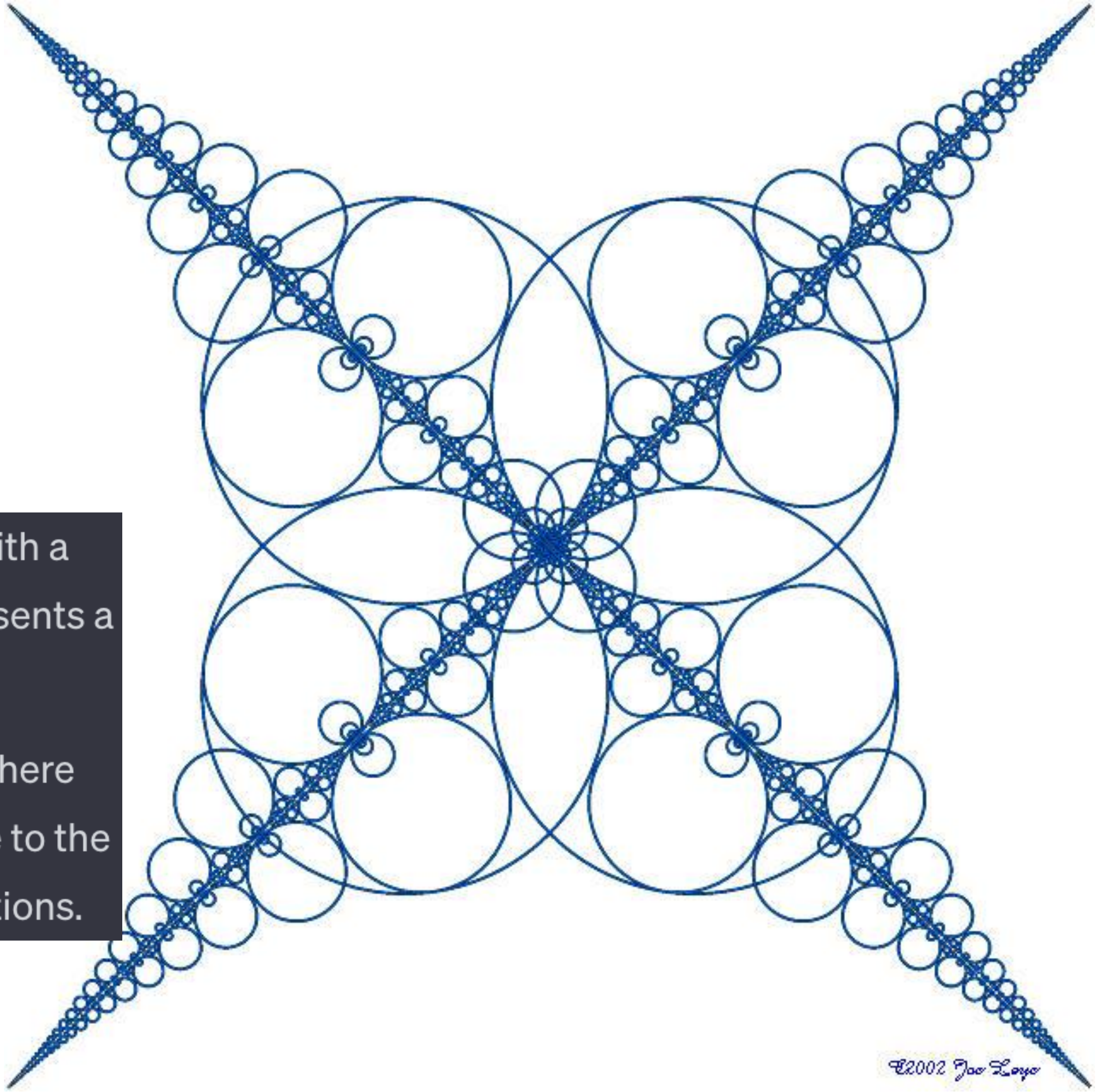
$$f_2(P) = \begin{bmatrix} 0.85 & 0.04 \\ -0.04 & 0.85 \end{bmatrix} P + \begin{bmatrix} 0 \\ 1.6 \end{bmatrix}$$

$$f_3(P) = \begin{bmatrix} 0.2 & -0.26 \\ 0.23 & 0.22 \end{bmatrix} P + \begin{bmatrix} 0 \\ 1.6 \end{bmatrix}$$

$$f_4(P) = \begin{bmatrix} -0.15 & 0.28 \\ 0.26 & 0.24 \end{bmatrix} P + \begin{bmatrix} 0 \\ 0.44 \end{bmatrix}$$

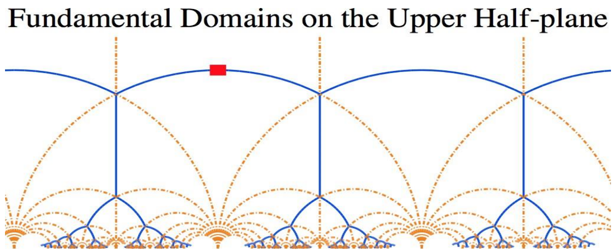
Ford Circles

- **Geometric Representation:** Ford circles visually depict rational numbers with a common denominator on a Cartesian plane using circles. Each circle represents a fraction $(\frac{p}{q})$ with its center at $\left(\frac{p+q}{2q}, \frac{1}{2q}\right)$ and a radius of $\frac{1}{2q}$.
- **Intersection Indicates Equivalency:** When two circles intersect at a point where both x and y coordinates are integers, they represent fractions that reduce to the same irreducible fraction, demonstrating relationships between these fractions.

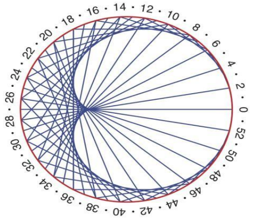


voting

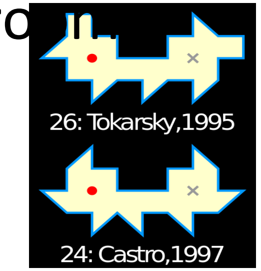
Fundamental domains



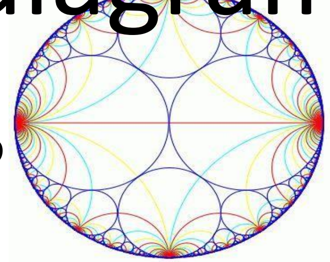
cardiods



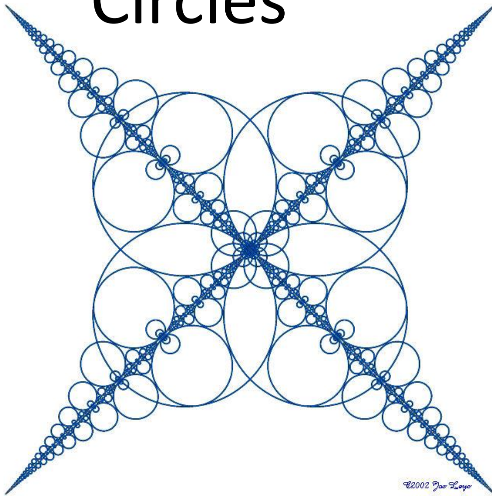
Tokarsky's unillumanable ro



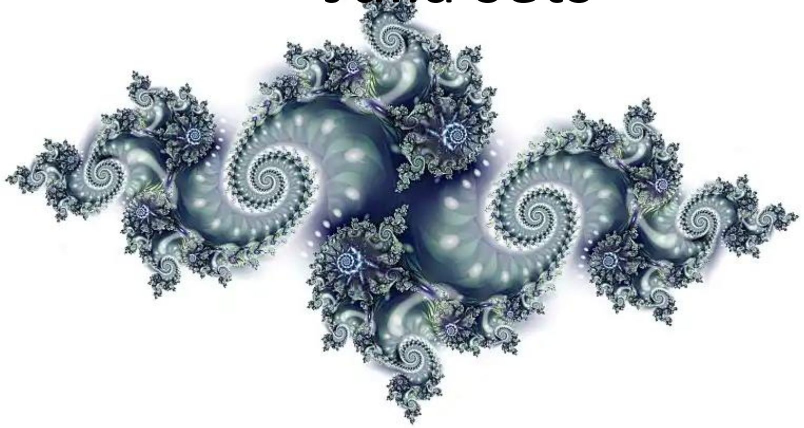
Farey diagrams



Ford Circles



Julia sets



Barnsley Fern

Dragon Curve