



Fractal Explorers: A Journey Through the Depths of Self-Similarity



Session 1

Meet the Team



Abi Bennett



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What country do you think has the longest coastline?

**WORLD
POLITICAL MAP**

Rank by longest coastline	Country	Coastline (in Km)
1	Canada	202,080
2	Norway	83,281
3	Indonesia	54,716
4	Greenland	44,087
5	Russia	37,365
6	Philippines	36,289
7	Japan	29,751

Rank by longest coastline	Country	Coastline (in km)	Land area (in km ²)
1	Canada	202,080	9,093,507
2	Norway	83,281	304,282
3	Indonesia	54,716	1,811,569
4	Greenland	44,087	2,166,086
5	Russia	37,365	16,377,742
6	Philippines	36,289	298,170
7	Japan	29,751	364,485

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Rank by longest coastline?	Country	Coastline (in km)
1	Canada	265,523
2	United States	133,312
3	Russia	110,310
4	Indonesia	95,181
5	Chile	78,563
6	Australia	66,530
7	Norway	53,199

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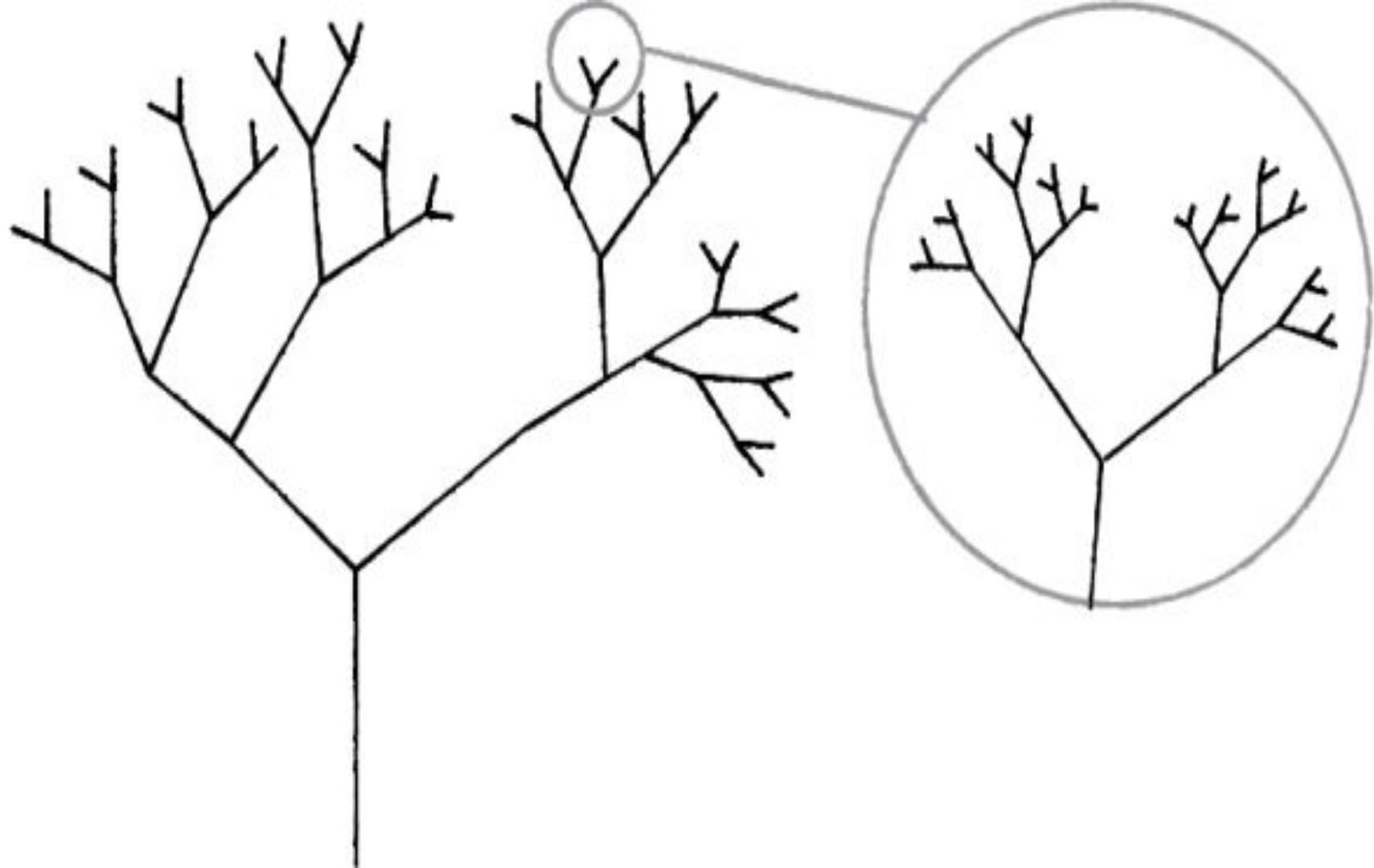


What is a fractal?





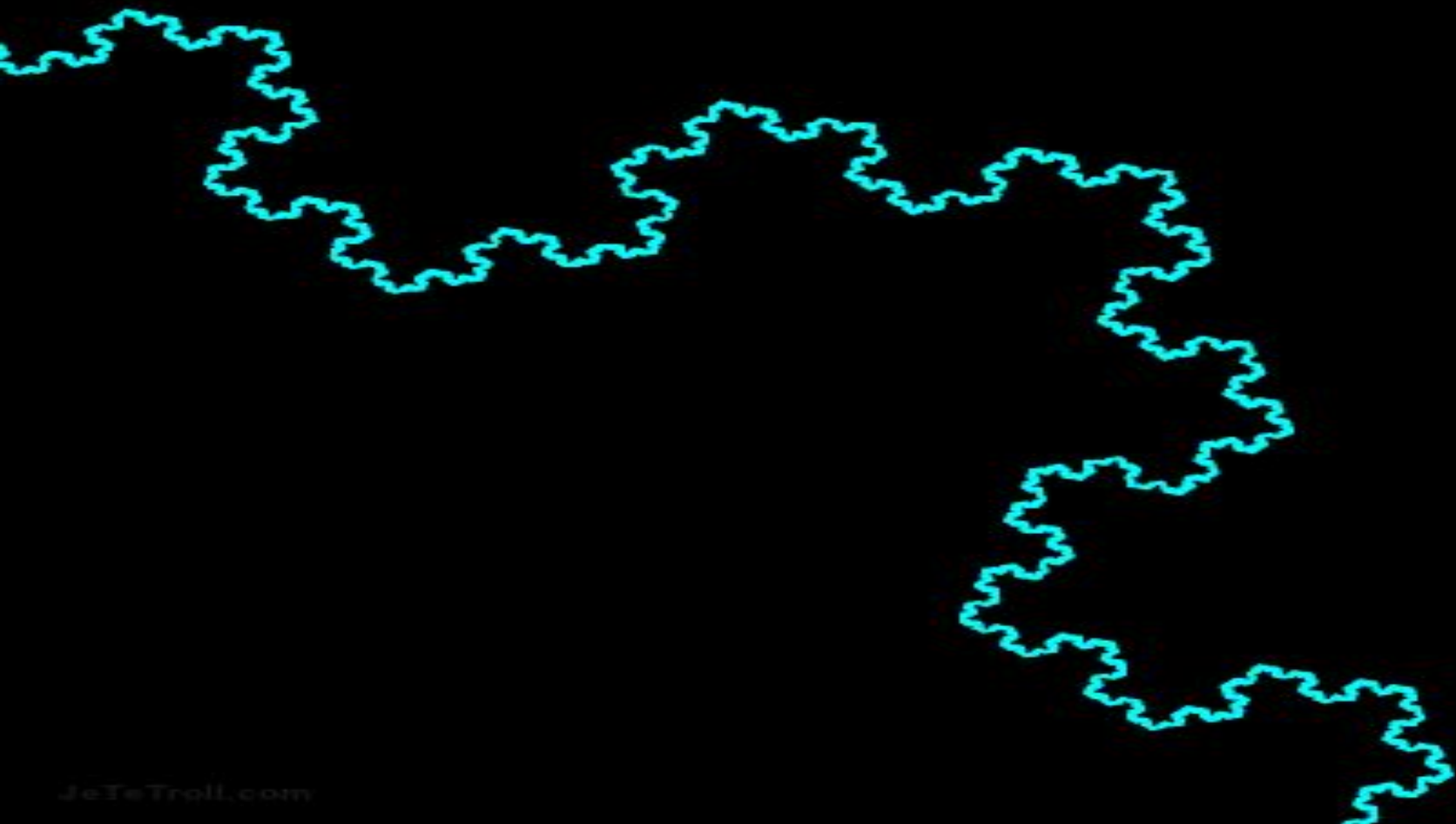
Self-similarity

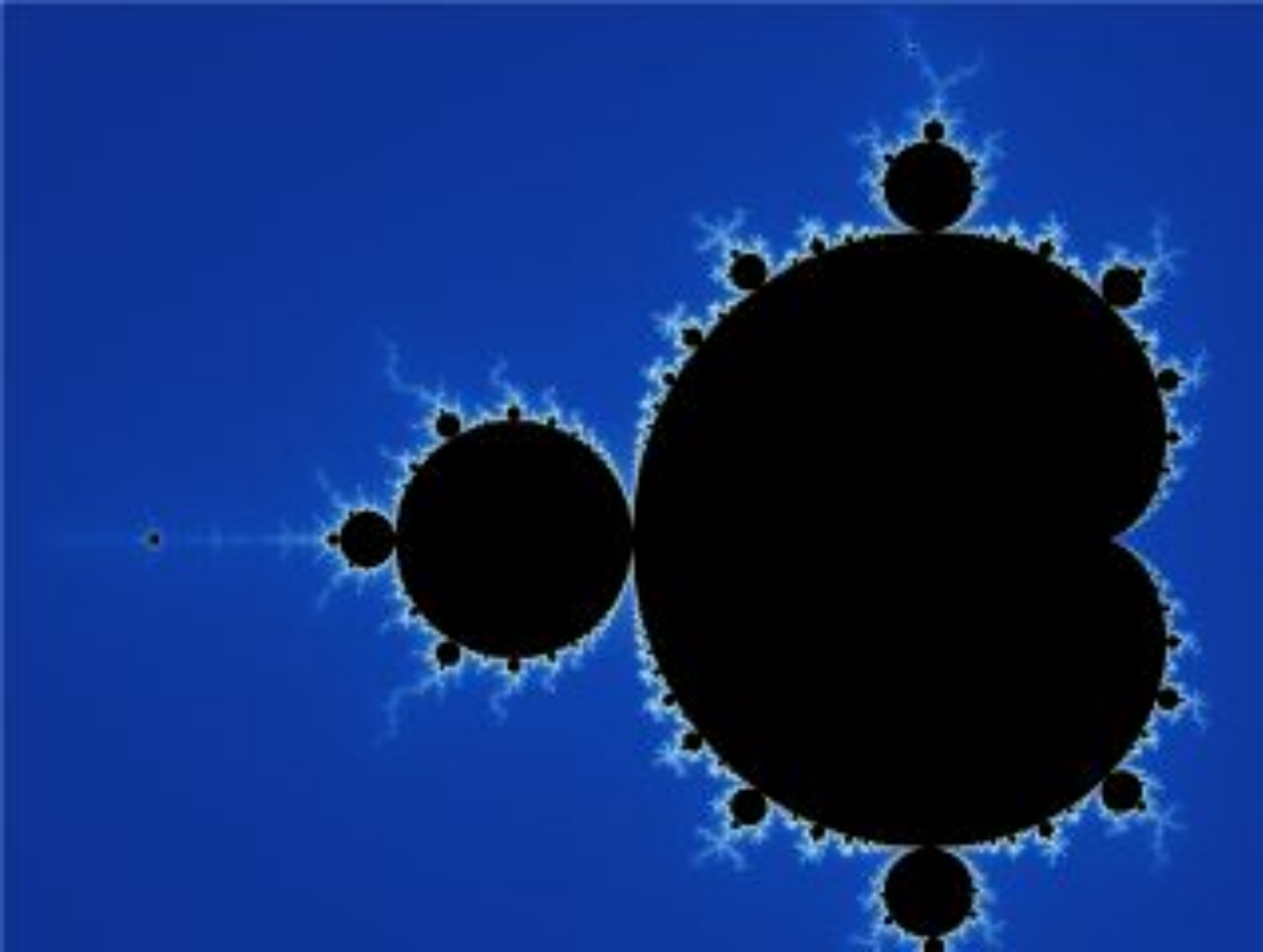


The background features several overlapping geometric shapes in teal, yellow, and green, arranged in a pattern that suggests self-similarity or fractal geometry. The shapes are primarily triangles and diamonds, some of which are partially cut off by the edges of the frame.

Exact self-similarity

Identical on all scales

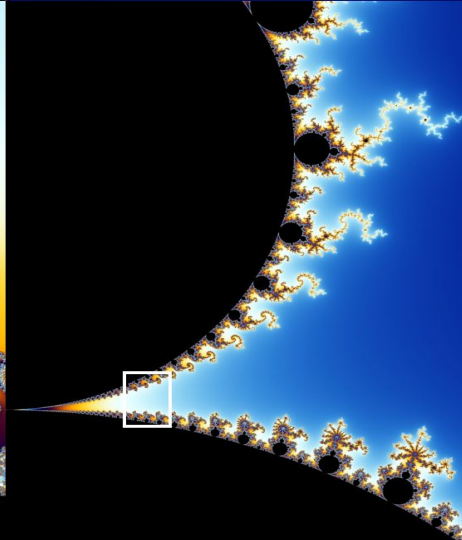
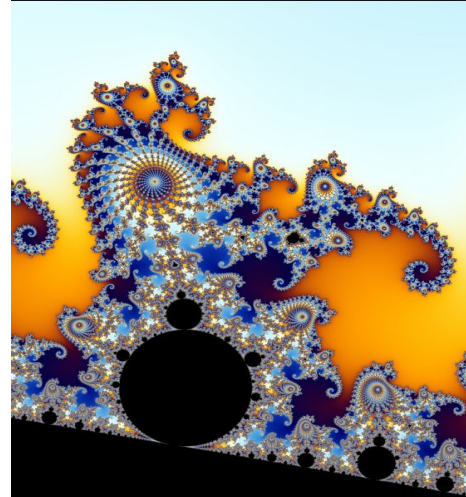
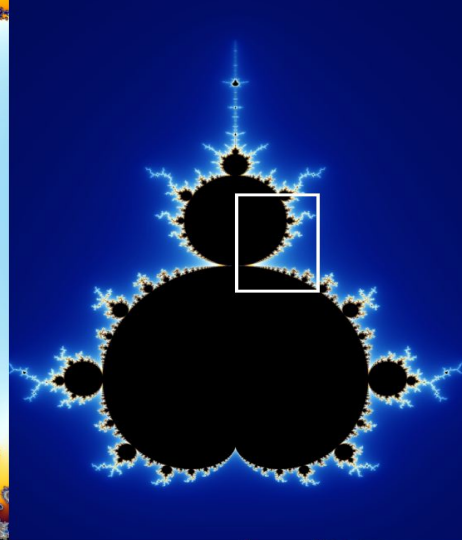
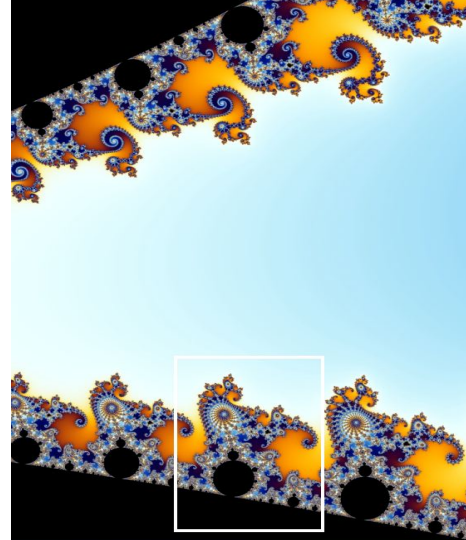




**Mandelbrot
Set**

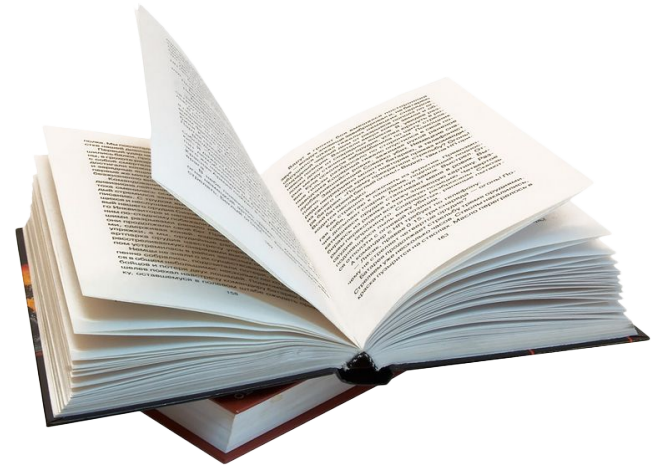
Quasi self-similarity

- Approximately the same on all scales
- It has distorted forms of the fractal in smaller scales



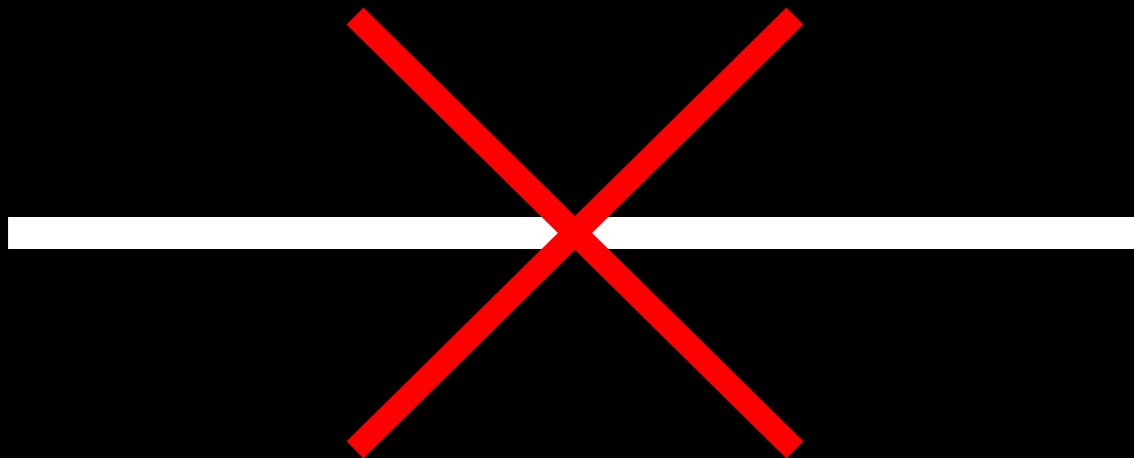
Statistical self-similarity


- A statistical pattern is repeated across different scales.
- It may not look exactly the same, but it has the same statistical properties.



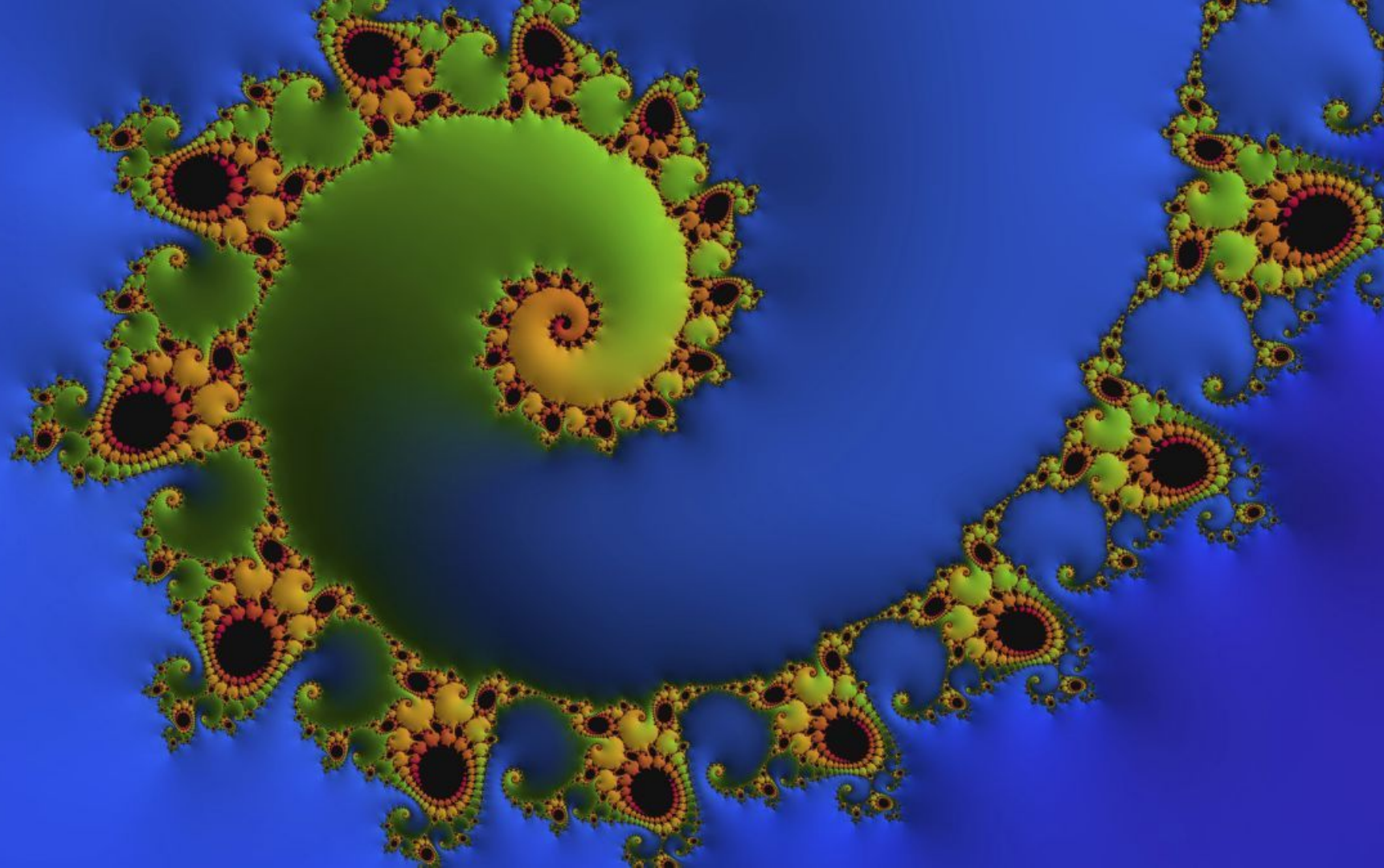


Not a fractal





**Test your
knowledge**





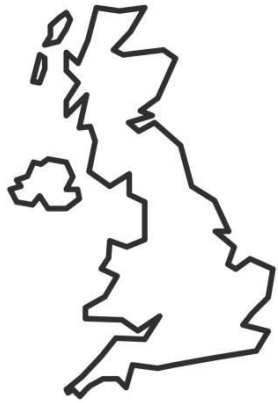




Workshop 1



Session 2



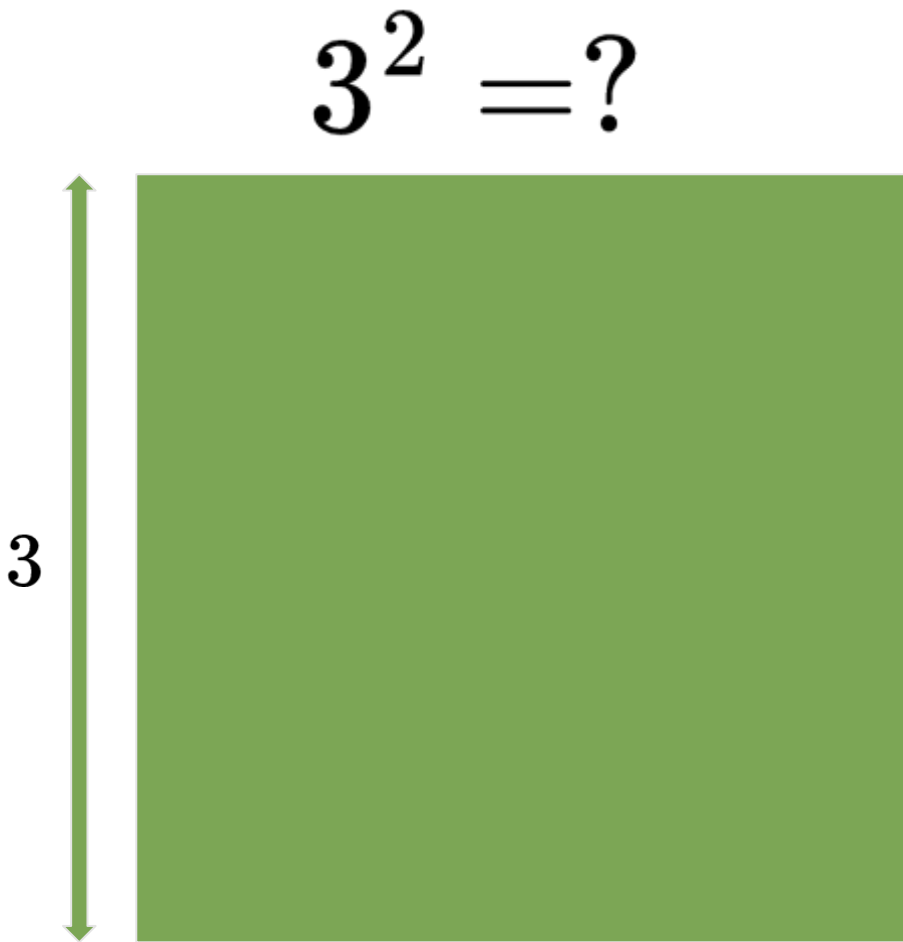
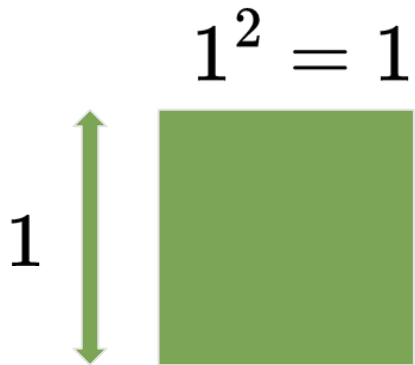
What have we discovered?

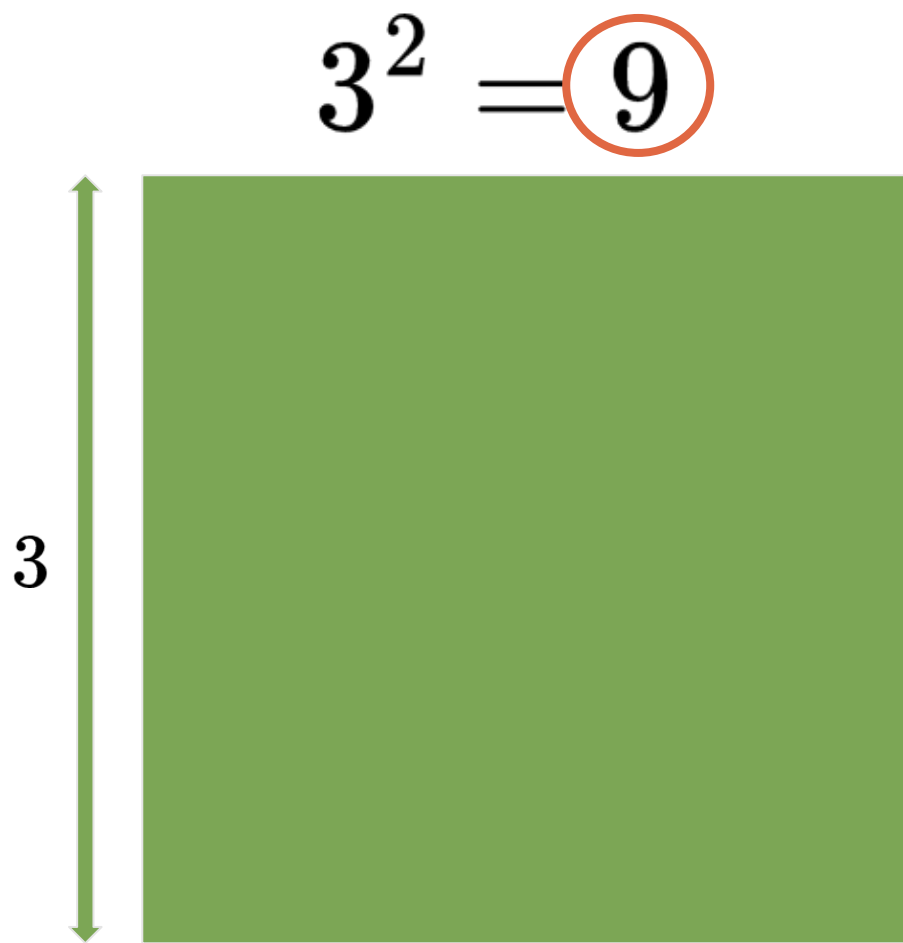
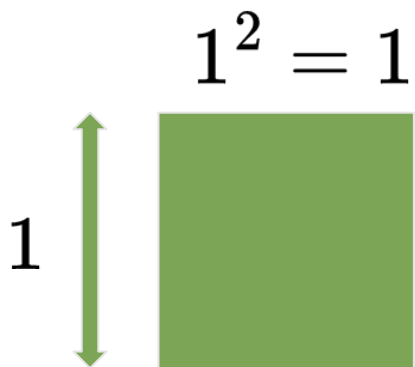


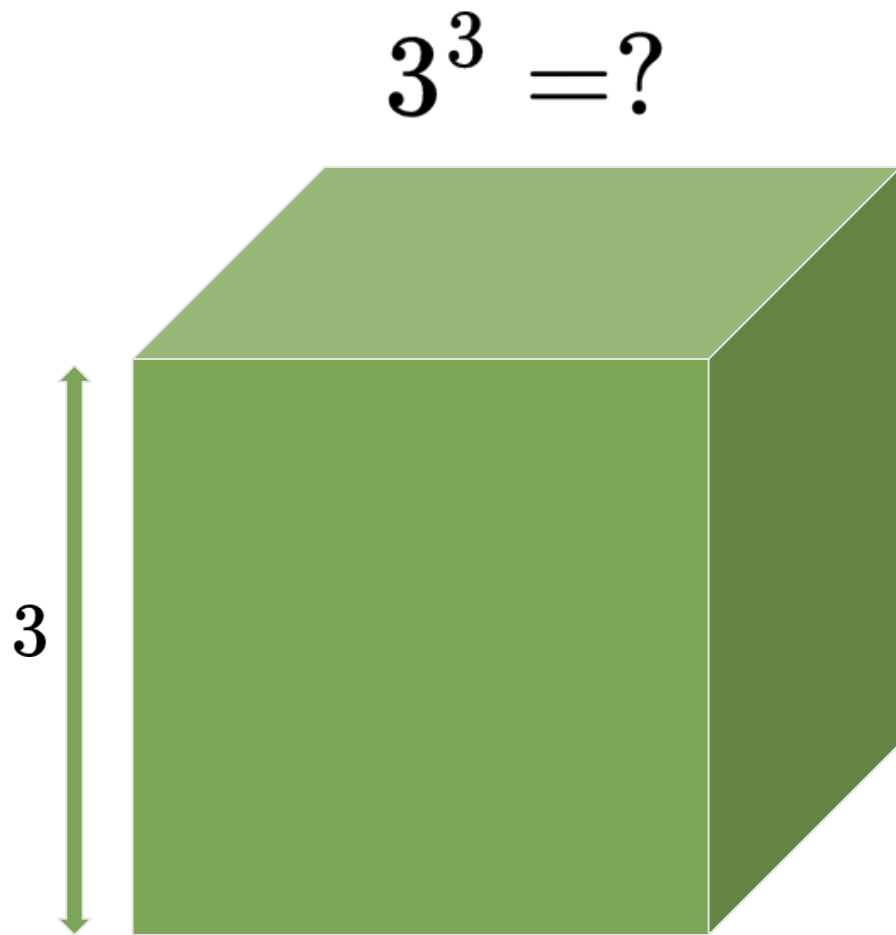
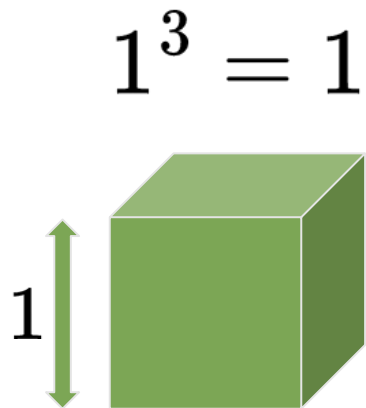


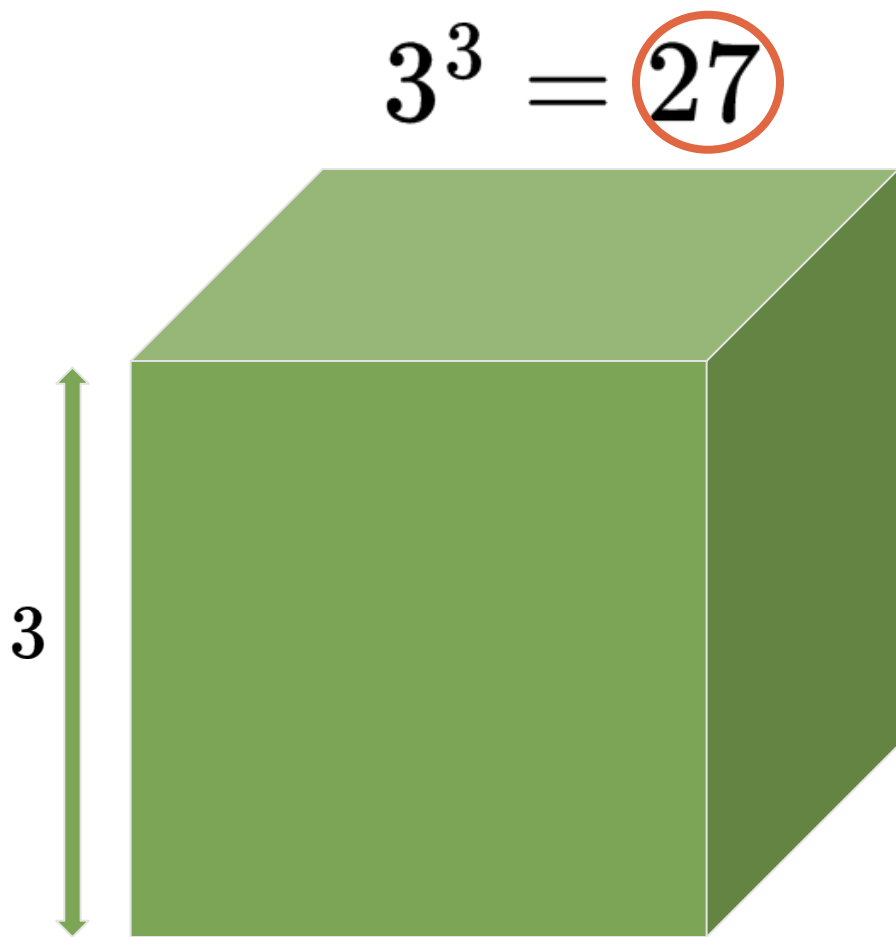
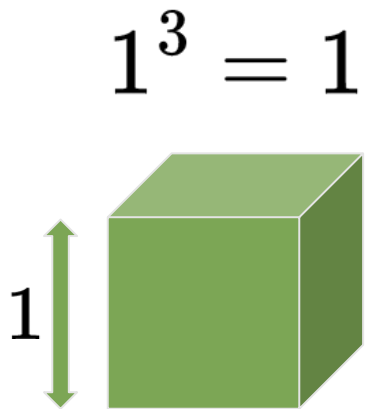


Fractal Dimension

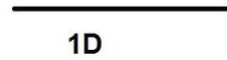








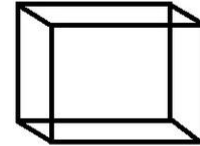
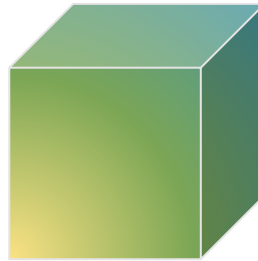
Can we have dimensions that are not whole numbers?



1D



2D



3D

The image features the word "YES!" in a large, 3D, blocky font. The letters are colored in a gradient: 'Y' is teal, 'E' is light green, 'S' is yellow, and the exclamation point is orange. The text has a slight shadow and a reflection below it. The background is white with several large, colorful geometric shapes: teal triangles, a green triangle, and yellow diamonds, all arranged in a dynamic, overlapping pattern.

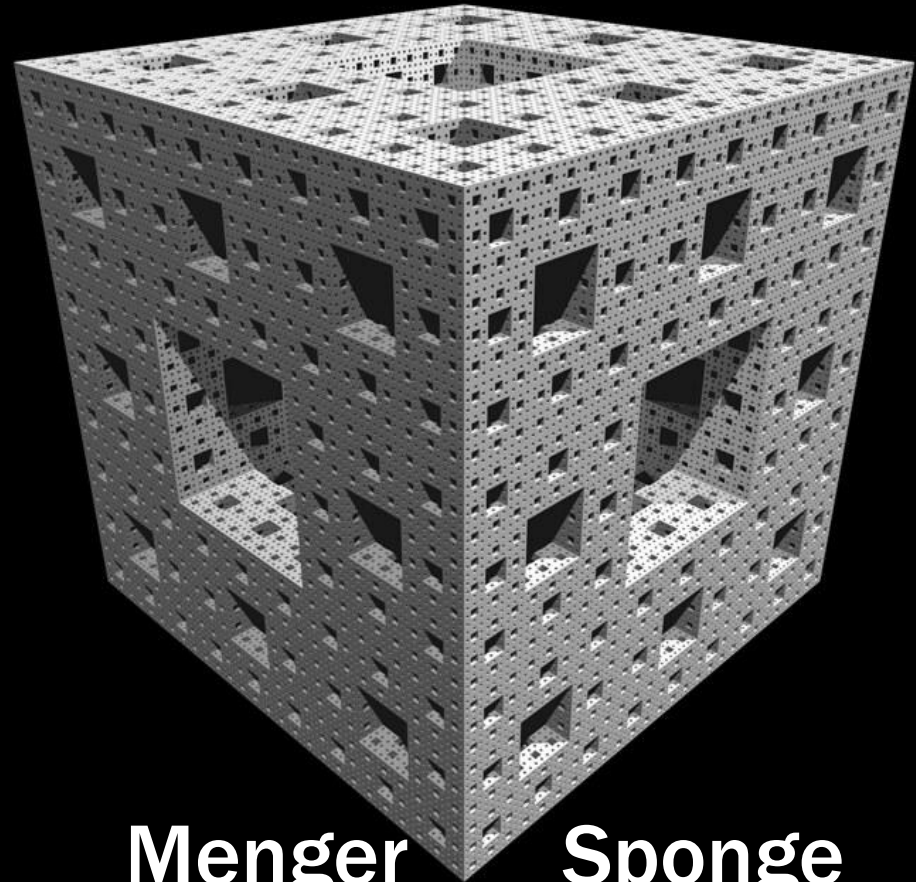
YES!



Felix Hausdorff

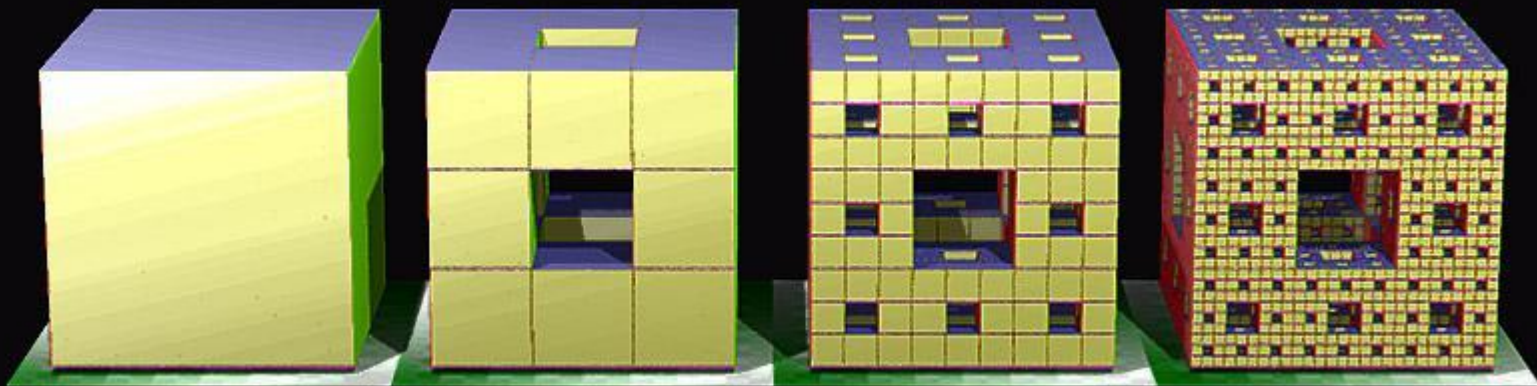
Hausdorff Dimension

Karl Menger



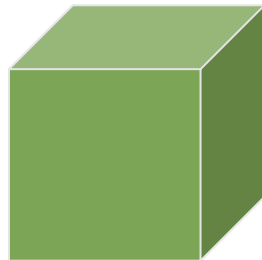
Menger

Sponge





$$3^{\textcircled{2}} = 9$$



$$3^{\textcircled{3}} = 27$$

$$3^x = 20$$

Find x by substituting different values for x between 2 and 3 and see how close you can get to 20.

$$3^x = 20$$

Hints

- Try to find x to three decimal places.
- If $x=2.5$, we get a value of 15.6. Is this too small?

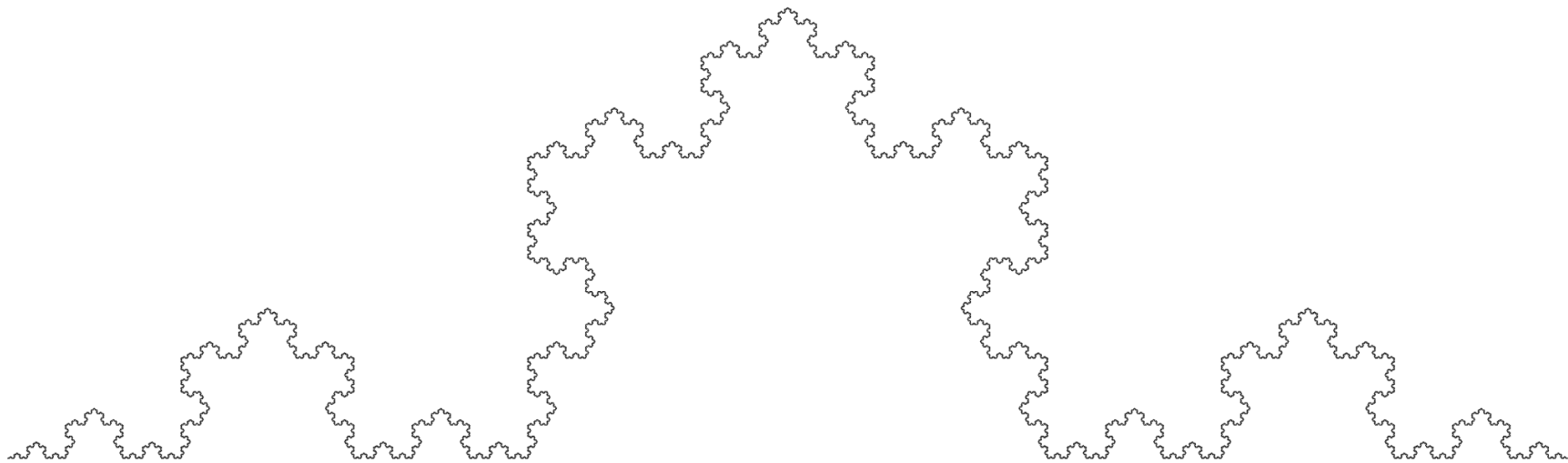
So what is the dimension of
the **Menger Sponge**?

$$3^{2.72683303} = 20$$

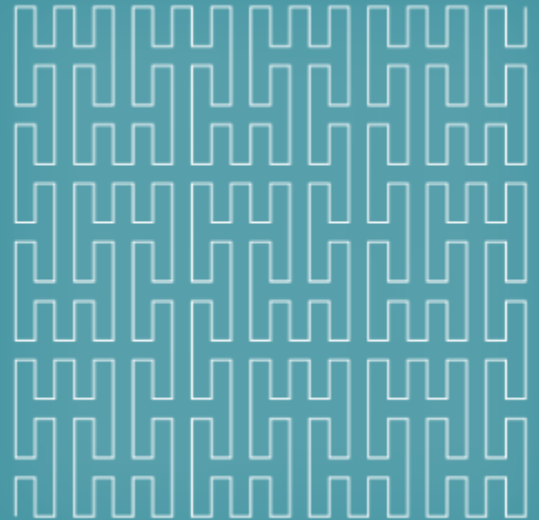
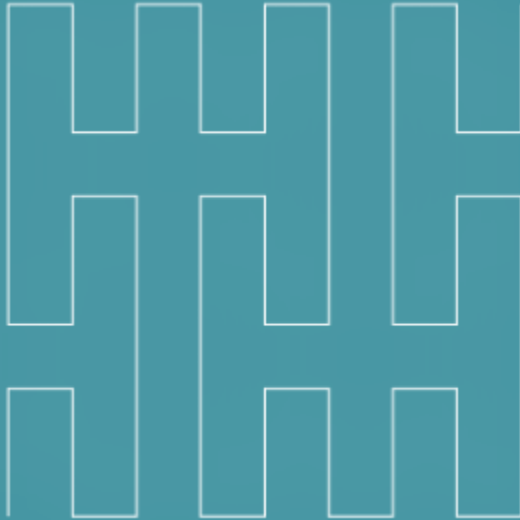
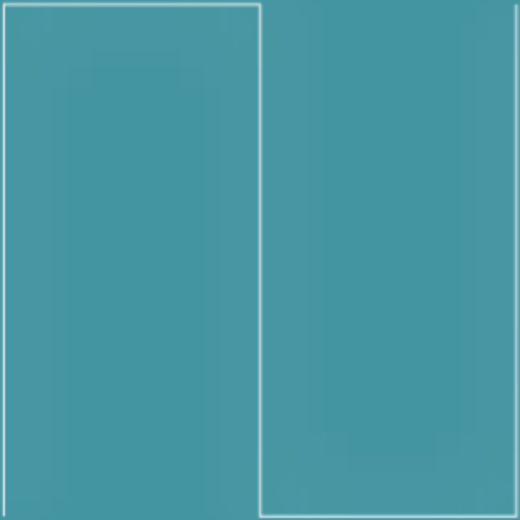
$$3^{2.727} = 20$$

So what is the dimension of
the **Menger Sponge**?

2.727



Koch Curve



Peano Curve



Workshop 2



Closing

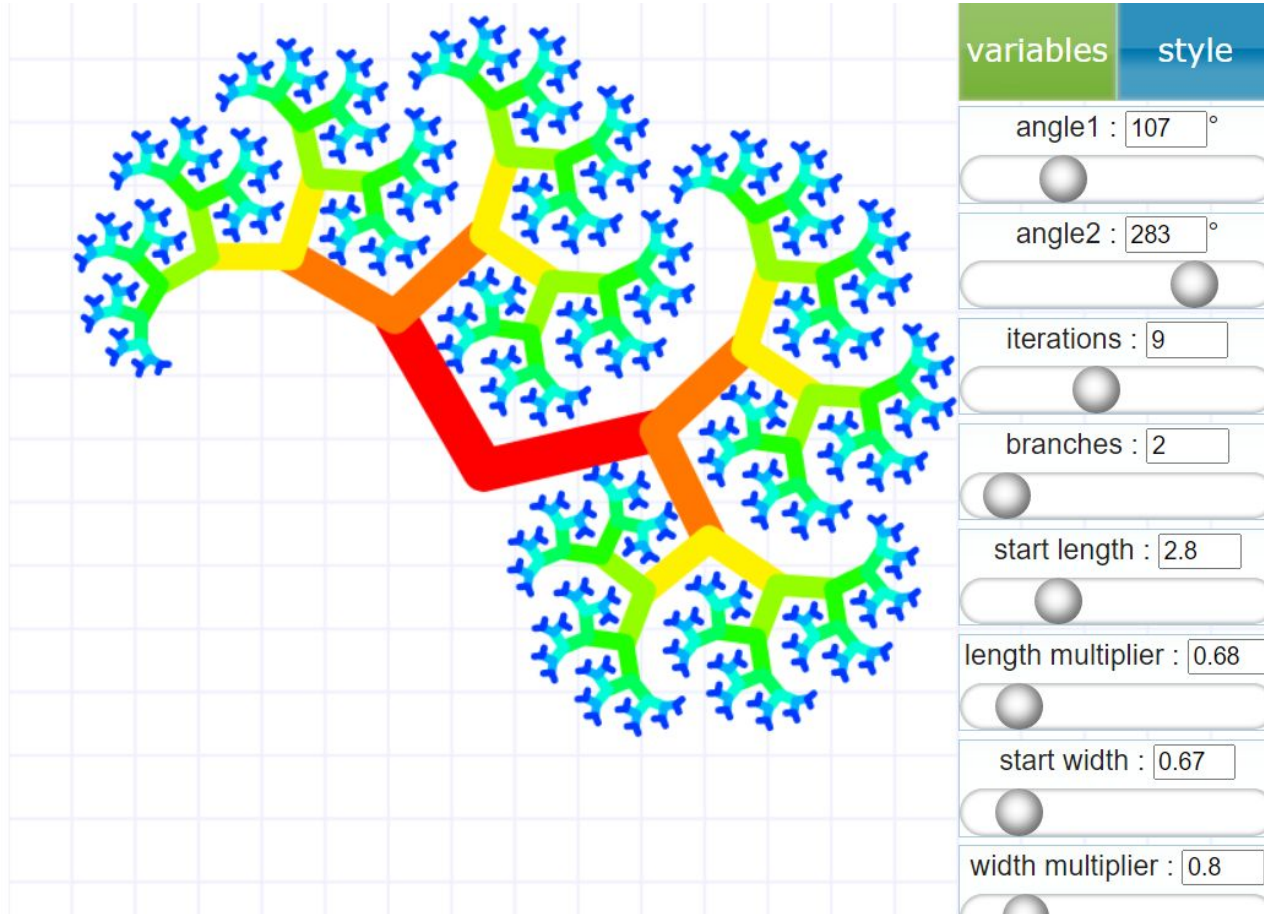
Further interest

Explore fractals everywhere!



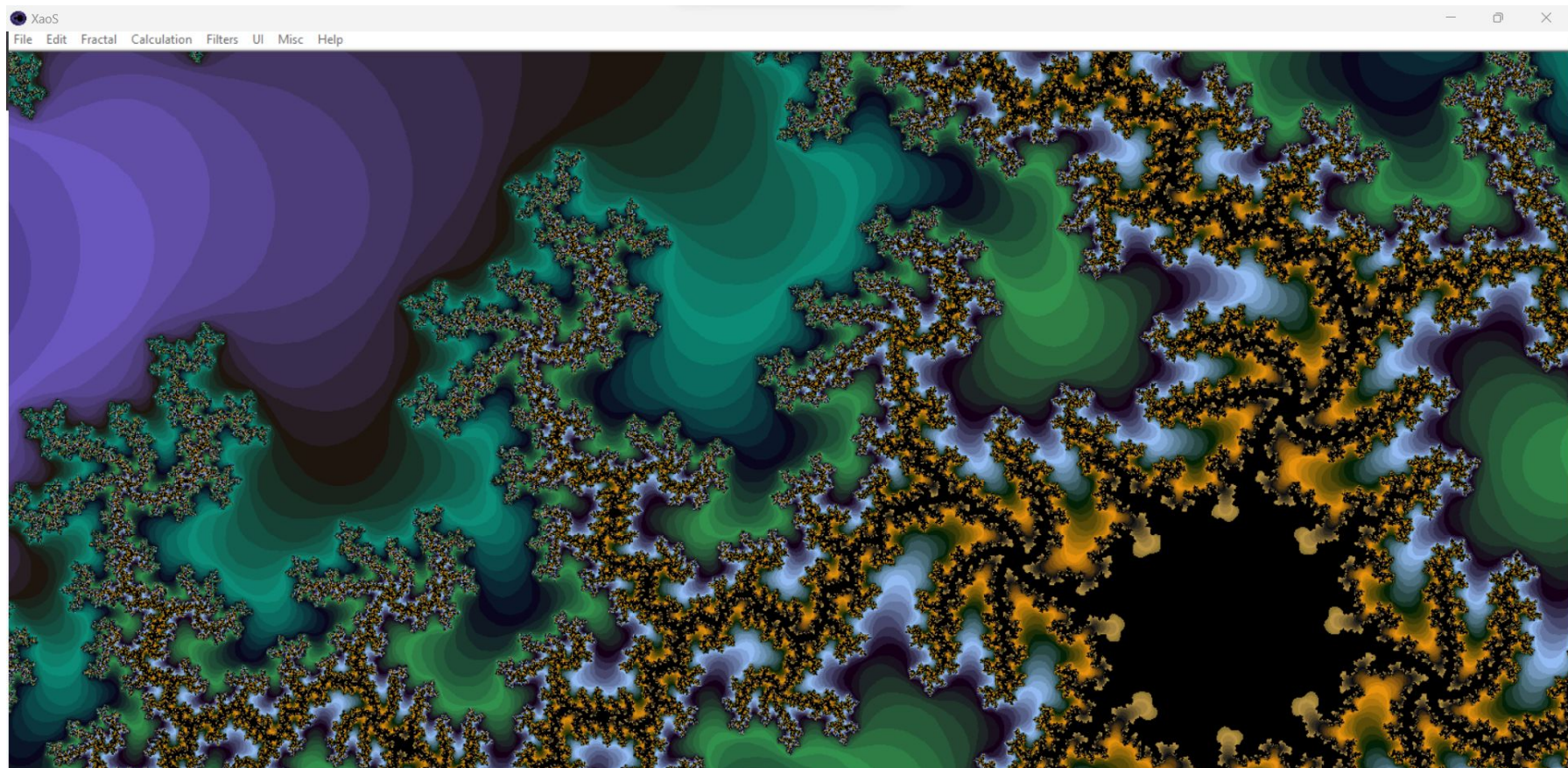
Visnos (visnos.com)

Online fractal generator



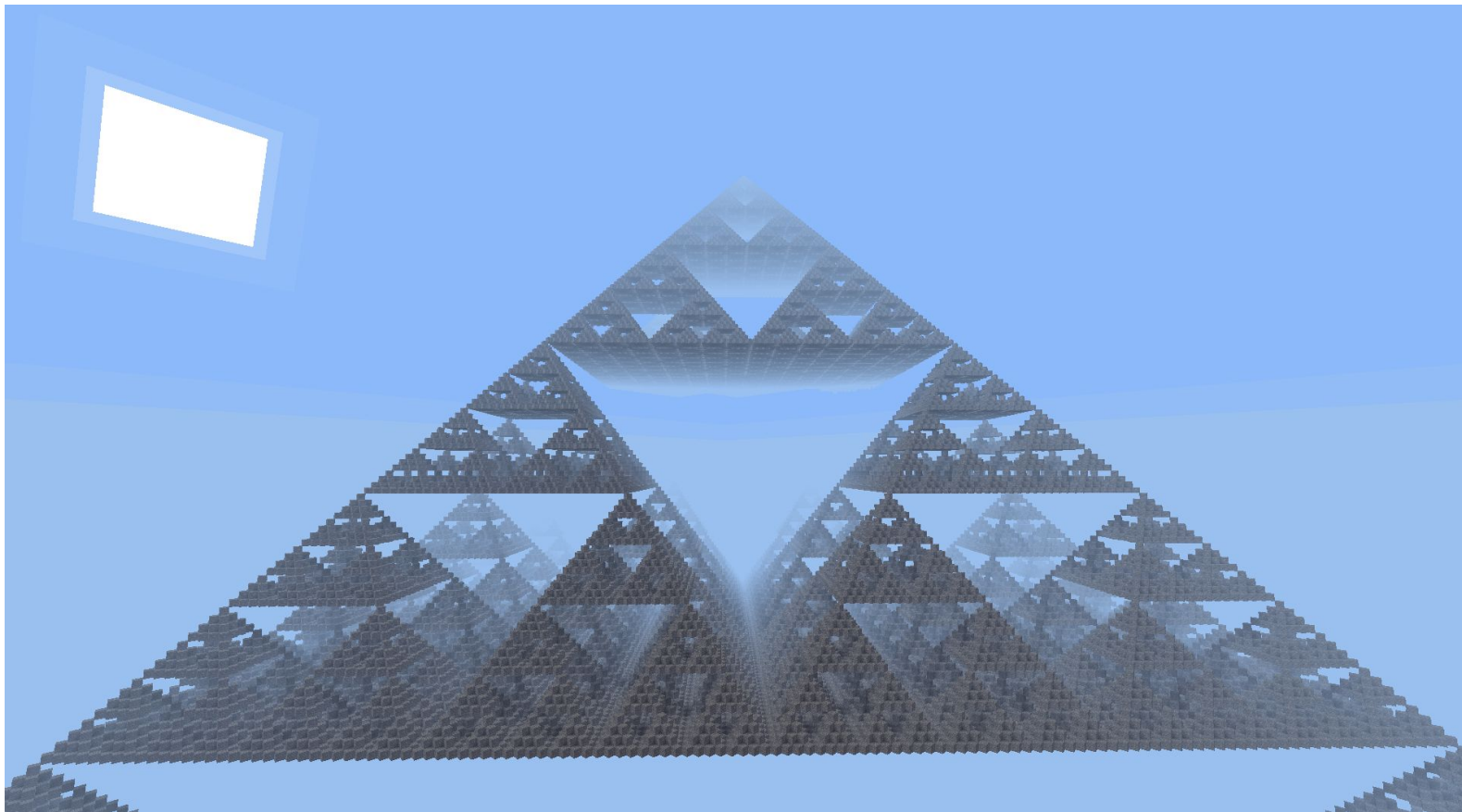
XaoS

Fractal explorer



Minecraft

Fractals in games!



Tell us how we've done!



Feedback forms for adults are available at the front