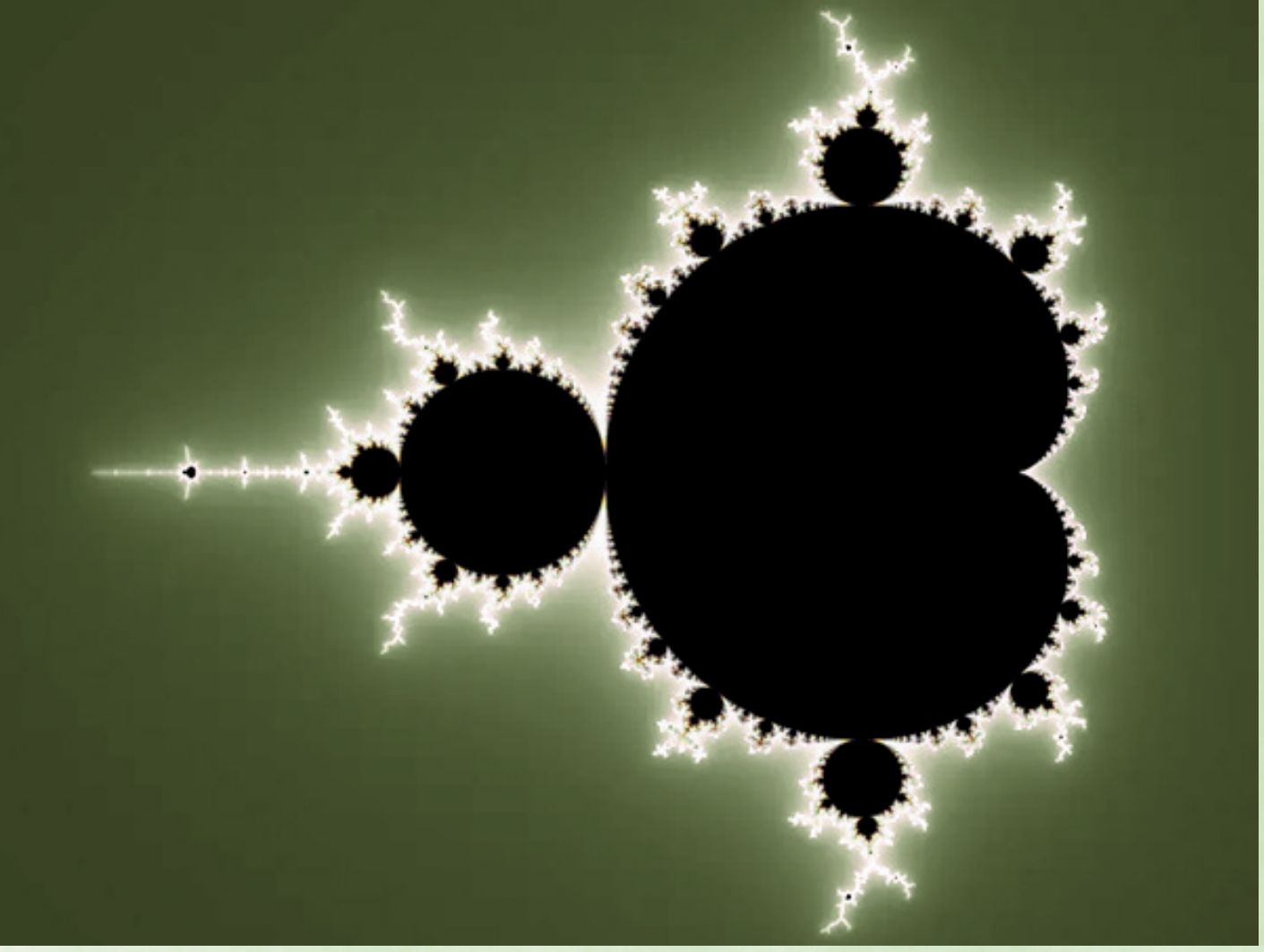


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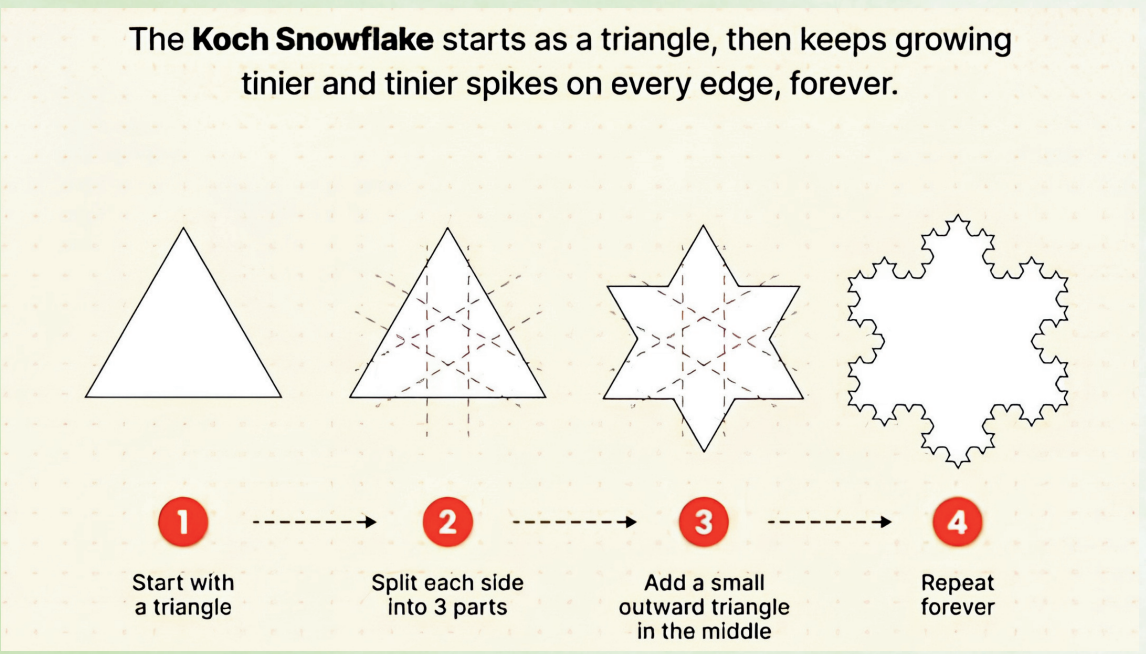
Fractals: The Magic of "Zooming In" Forever

Imagine you have a picture of a tree. If you zoom in on a small branch, it looks just like a miniature version of the whole tree. If you zoom in even closer on a tiny twig, it still looks like a branch! This magical idea is called a fractal.

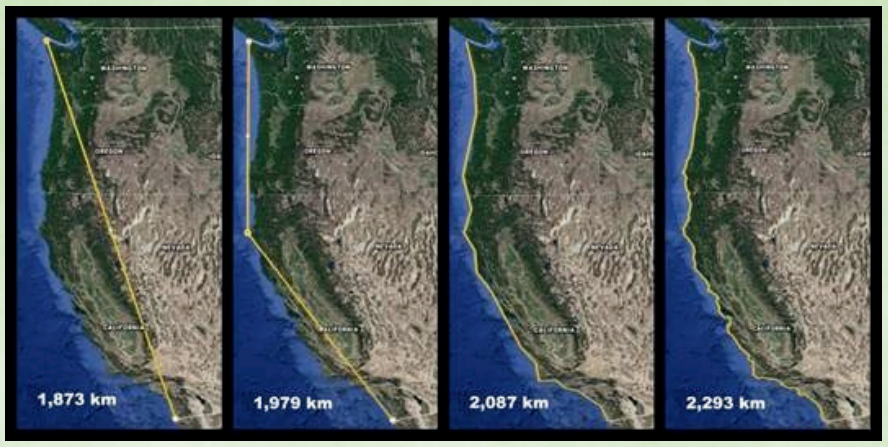
The word "fractal" was created by a mathematician named Benoît Mandelbrot in 1975. It comes from a Latin word meaning "broken" or "fragmented." The most important rule of a fractal is self-similarity: no matter how much you zoom in, you will always see the same pattern repeating itself.

Six Fast Facts About Everyday Fractals

1. Coastlines: How long is the coastline of an island? The answer depends on the size of your ruler! Because coastlines are bumpy and jagged like a fractal, the smaller your ruler, the more tiny rocks and bays you measure. If you could measure every single grain of sand, the coastline would actually be infinitely long!



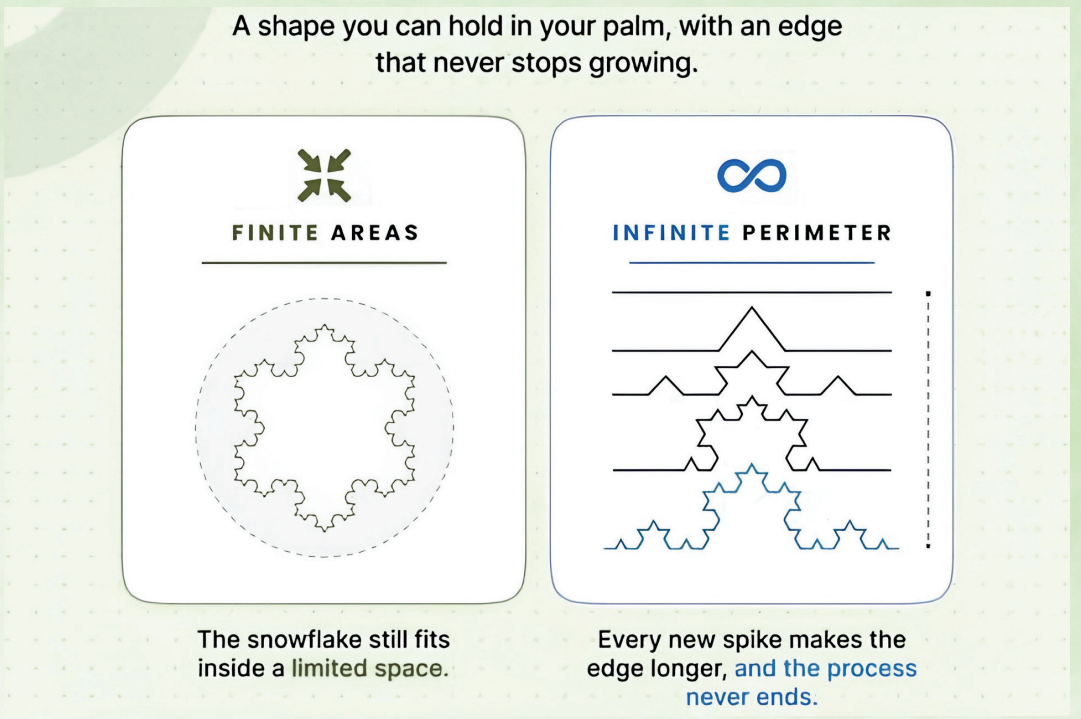
2. Lungs: Your lungs need a huge surface area to help you breathe. Nature solved this using fractals! Your lungs branch out like an upside-down tree. Because of this fractal design, your lungs have the surface area of a tennis court (about 70 square meters), all folded up inside your body!



3. Snowflakes: The Koch snowflake is made by adding tiny triangles to the edges of a bigger triangle, over and over again. It has a crazy paradox: its perimeter (the outside edge) goes on forever and is infinitely long, but the space inside it (the area) is actually very small and limited!

4. Nature's Efficiency: Fractals are nature's best way to be super efficient. Trees use fractal branches to catch as much sunlight as possible. Their roots use the exact same branching pattern to soak up water.

5. Video Game CGI: Have you ever wondered how computer games create realistic mountains, clouds, or alien planets? Artists use fractal math! By using a few simple rules that repeat over and over, computers can generate endless, beautiful landscapes that look exactly like nature.



From the tiny blood vessels in your body to the giant branches of trees, fractals show us that the universe loves to repeat simple patterns to create amazing, complex things!

Does a 12-Inch Pizza Equal Two 6-Inch Pizzas?

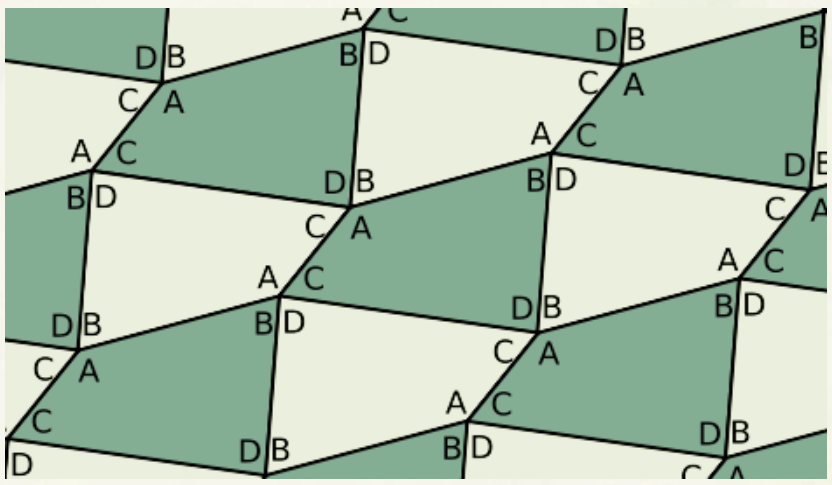


No! A 12-inch pizza is actually twice as big as two 6-inch pizzas combined.
In math, when you double the width (diameter) of a circle, its area doesn't just double - it quadruples!

One 12-inch pizza has an area of about 113 square inches.
Two 6-inch pizzas only have a total area of about 56 square inches.
Because one 12-inch pizza can fit four 6-inch pizzas inside it, getting one big pizza always gives you much more food than two small ones!

Do you know that any kind of quadrilateral can tile a flat surface using only itself?

Any quadrilateral can tile a flat surface because its interior angles sum to 360°. Placing all four angles together at every vertex eliminates gaps, creating a tessellation.

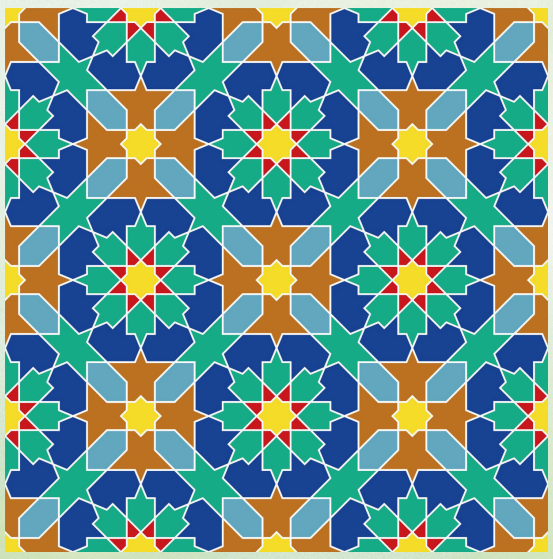


If you want to tile using only one type of regular polygon, the interior angle of this regular polygon must be a factor of 360. Examples include:

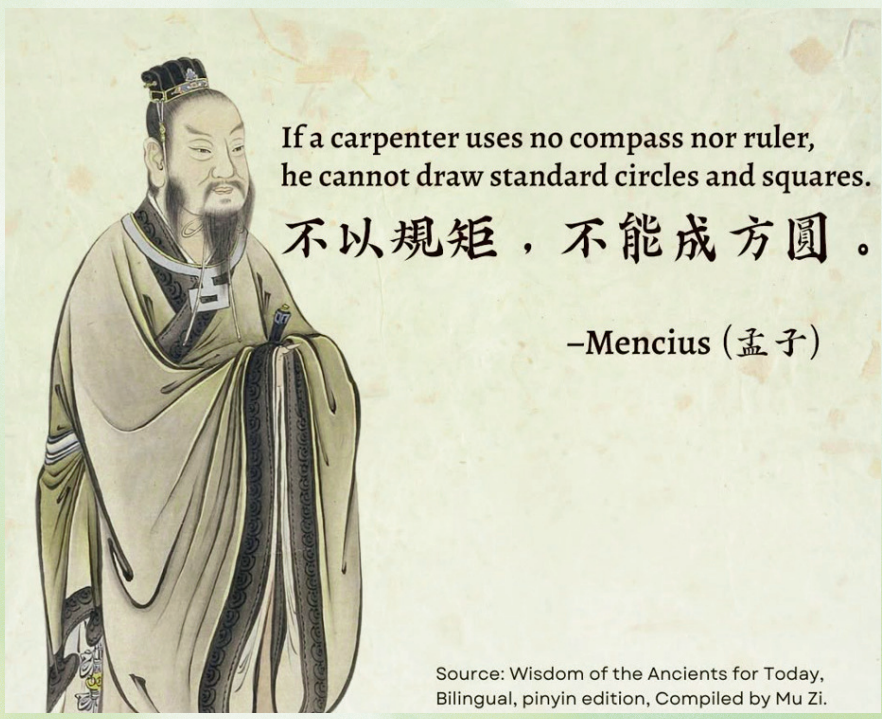
- ▲ Regular triangles with an interior angle of 60° (60° × 6 = 360°)
- ◆ Squares with an interior angle of 90° (90° × 4 = 360°)
- ⬢ Regular hexagons (6-sided polygon) with an interior angle of 120° (120°×3 = 360°)

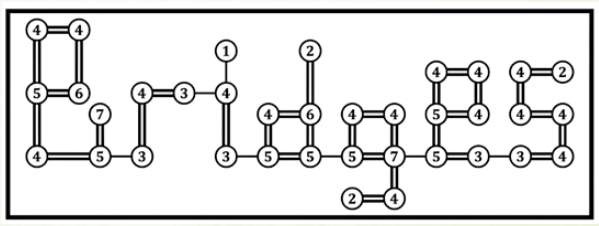
What about a regular pentagon (5-sided polygon)? Its interior angle is 108°, which cannot divide 360 evenly. Therefore, it is impossible to tile a flat surface using only regular pentagons.

However, Persian Girih tiles solved this 800 years ago by combining regular pentagons, decagons, rhombuses, and special hexagons whose combined angles sum to 360° at each vertex.



Geometric Girih tile tessellation pattern.





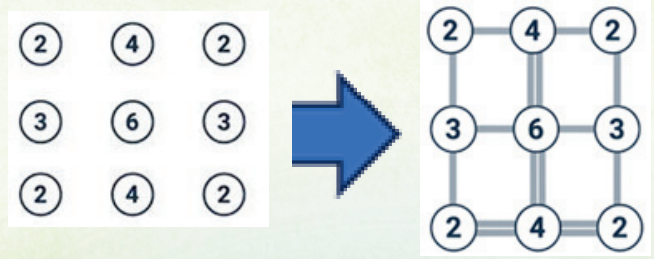
Bridges (Hashi) — Quick Rules

Goal: Connect all islands into a single, fully connected network using straight lines (bridges).

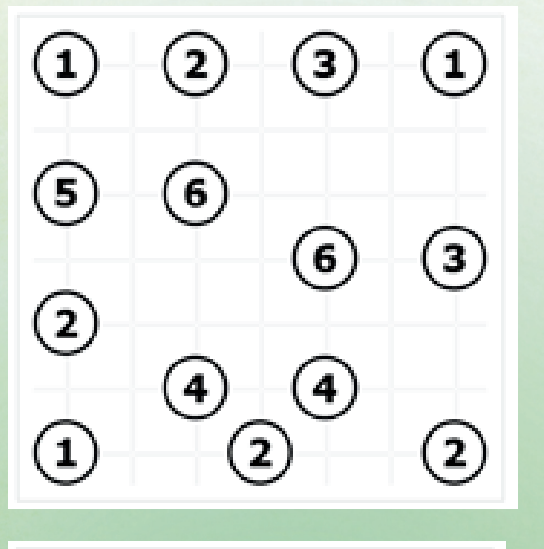
The 5 Core Rules

1. Straight Lines Only: Bridges can only run horizontally or vertically—never diagonally.
2. No Crossing or Jumping: Bridges cannot cross other bridges or pass over islands.
3. Maximum 2 Bridges: You can draw at most two parallel bridges (a double bridge) between any pair of islands.
4. Match the Island Value: The number inside an island indicates the exact total number of bridges that must attach to it.
5. Single Connected Network: All islands must be connected into a single continuous group. You cannot have disconnected subnetworks or closed loops isolated from the rest.

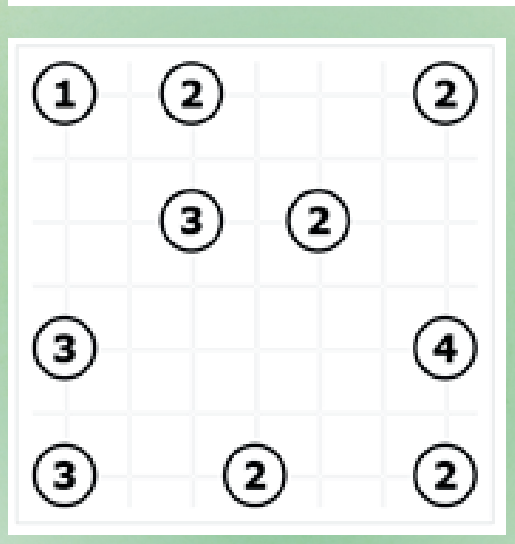
For example:



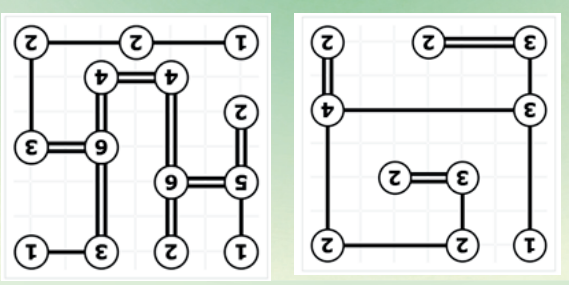
Game 1:



Game 2:



Solution:



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