How are snowflakes mathematical?

- ESHAAN VERMA, 5TH GRADE
- TAMBARK CREEK ELEMENTARY SCHOOL

- STEM PROJECT TYPE - RESEARCH

Question and purpose for this research project

How snowflakes are formed and what are different shapes of snowflakes?

How snowflakes are mathematical?

What is the most interesting fact we learned about snowflakes?

How we will use what we learned in this project?

My Predictions and Hypothesis

Snowflake are formed when temperature is low and freezing

Snowflake are formed through ice crystal

They slowly form a shape through multiple triangle or hexagon attached together

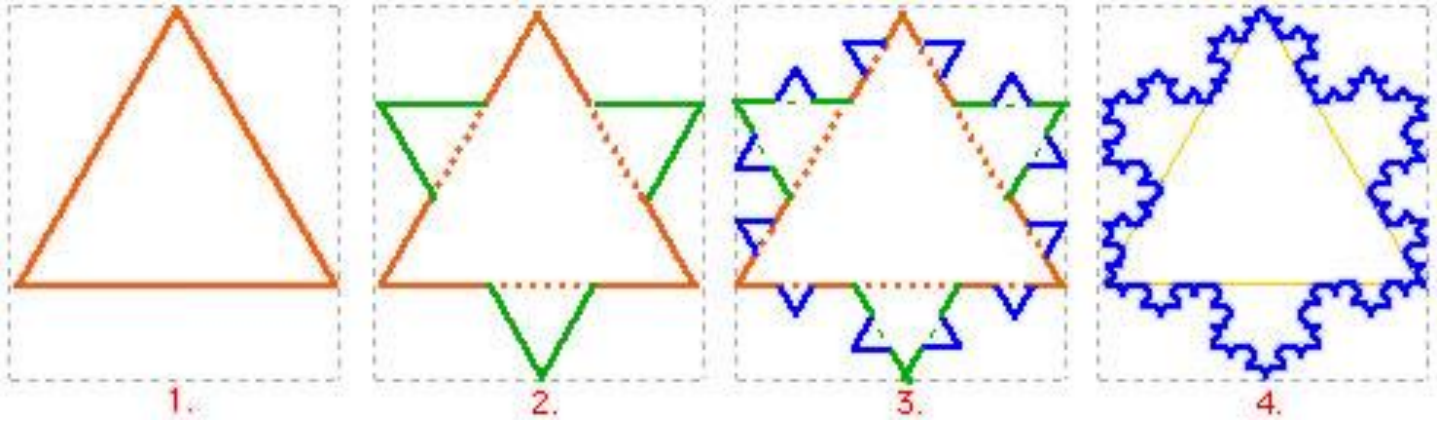
How snowflakes are mathematical?

In mathematics, a geometric pattern that is repeated at ever smaller scales is known as a fractal.

Fractals that are similar to snowflakes are known as snowflake fractal.

We will try to calculate the perimeter and the area of a specific snowflake fractal

We start with an equilateral triangle and then in each iteration we build additional equilateral triangles on the middle third of each of the sides



Experiment: Snowflake Fractal

This fractal that is also known as the Koch island, was first described by Helge von Koch in 1904.

It is built by starting with an equilateral triangle, removing the inner third of each side.

Building another equilateral triangle at the location where the side was removed,

Then repeating the process indefinitely

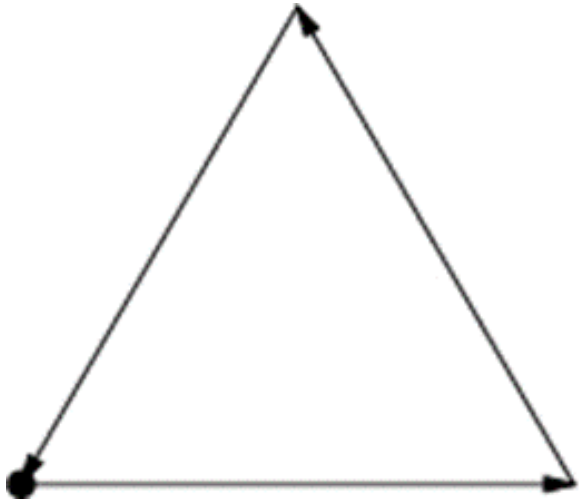
Procedure

Start with an equilateral triangle whose sides have length 1.

On the middle third of each of the three sides, build an equilateral triangle with sides of length 1/3. Erase the base of each of the three new triangles.

On the middle third of each of the twelve sides, build an equilateral triangle with sides of length 1/9. Erase the base of each of the twelve new triangles.

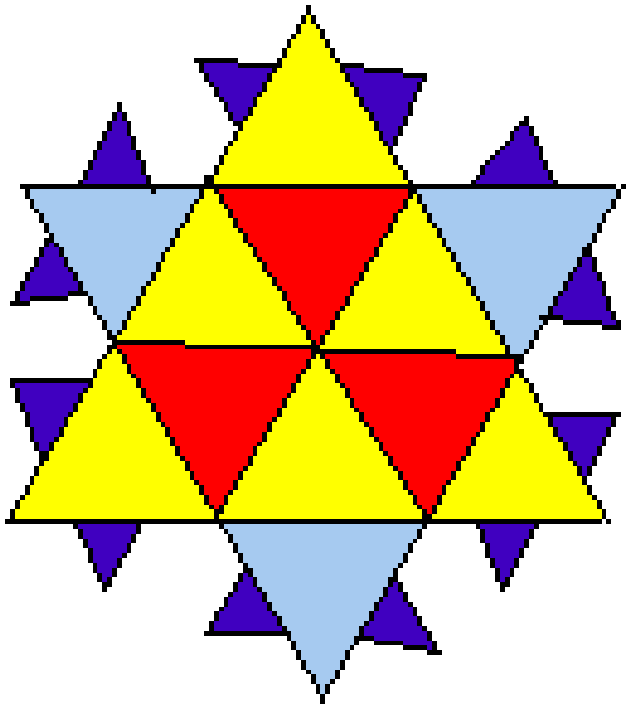
Repeat the process with this 48-sided figure. See the likeness to a crystal of snow emerge?



How to calculate the perimeter and area?

Perimeter: To calculate the perimeter, first determine the number of lines after n iteration. Then determine the size of each side or line after n iteration. Finally, we can multiply the number of sides by the length of each side.

Area: To calculate the area, determine how many smaller triangles are being added in each iteration. Also determine the size of each triangle in each iteration. You can then add the initial size of triangle to the size of triangles that are being added in each iteration.



Conclusion

Snowflakes are mathematical because Snowflakes have symmetry.

This means that its different parts match in size, shape, and position.

If we look at one half of a snowflake, it will match the other half.

They have patterns of triangles and hexagons and we could calculate the perimeter and the areas of the snowflakes using number of sides, length of the sides, and iteration.

I learned that there are different types of snowflakes shapes such as there are around 120 different classifications for snowflakes, based on their shape.

For example, plates are large and flat snowflakes. Needles are long and thin snowflakes. Dendrites, the most popular shape look like stars

Sources

1. Koch snowflake fractal - https://www.khanacademy.org/math/geometry-home/geometry-volume-surface-area/koch-snowflake/v/koch-snowflake-fractal
2. The Beauty & Science of Snowflakes - https://ssec.si.edu/stemvisions-blog/beauty-and-science-snowflakes
3. The Science of Snowflakes, - https://www.pbs.org/newshour/science/the-science-of-snowflakes
4. The mathematics of snowflakes - https://scienceproject.com/projects/detail/Senior/SP011A.asp
5. The mathematics of snowflakes - https://www.scienceprojects.org/the-mathematics-of-snowflakes/