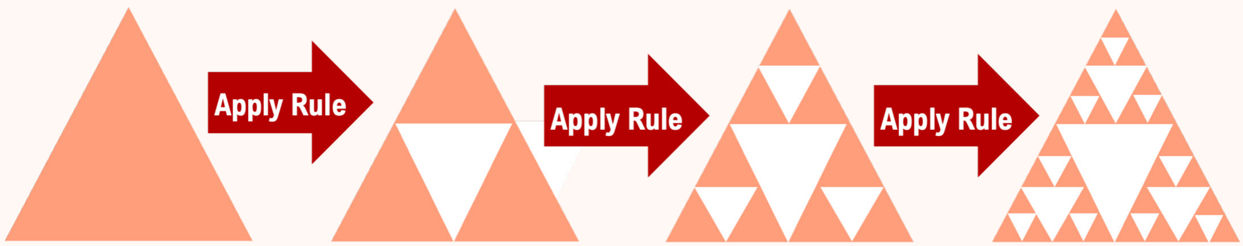
TOPIC: INTRODUCTION TO FRACTALS

Intro to Fractals

- **Fractals** are formed by starting with a figure & applying the same rule ____________, one step at a time (**recursion**).
  - ► Fractals have **self-similarity**, which means each smaller piece of the fractal looks like the ________ fractal.

New — **Sierpinski Triangle**

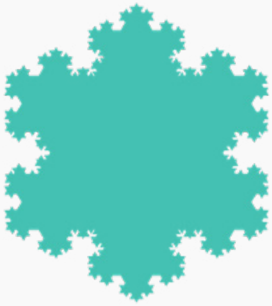
Start With: Equilateral Triangle
Rule: Cut out each 'center triangle'



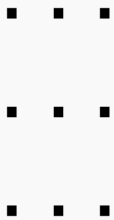
- Eventually, the fractal becomes **visually stable** when changes between steps become *so* small, we can't see them.

PRACTICE Determine if the following figure has self-similarity.

(A)



(B)



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EXAMPLE Use the starting figure and rule to complete the first three steps of the fractal-like figure.

Starting Figure: Square

Rule: Divide all squares in quarters

EXAMPLE Use the starting figure and rule to complete the first three steps of the fractal-like figure.

Starting Figure: Vertical line segment

Rule: Each line segment branches off into 2 line segments half the size (like a small v)

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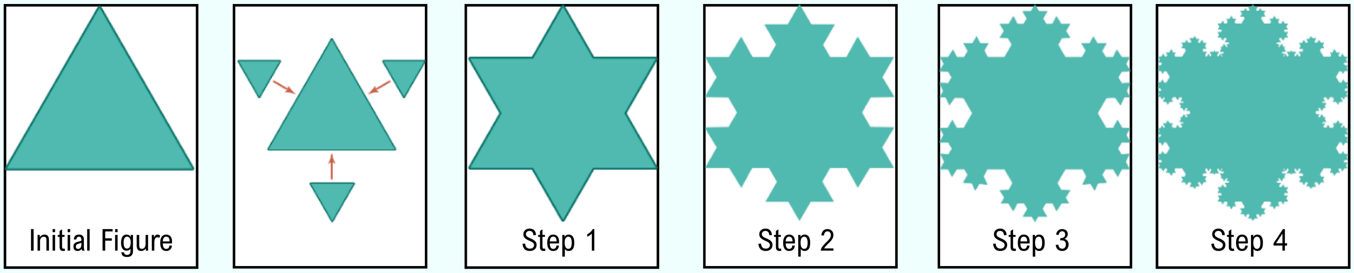
EXAMPLE

The Koch Snowflake is a fractal that starts with an equilateral triangle. For each step, a new equilateral triangle, a third of the size, is added on the sides of each equilateral triangle in the figure. The first few steps are pictured below.



($\boldsymbol{A}$) If the original sides of the starting equilateral triangle are 1 unit, the perimeter of the figure in step n is given by: $L = 3\left(\frac{4}{3}\right)^n$. Finish filling in the table below with the perimeters of the first 4 steps. If we continued the recursive process infinitely many times, why would the perimeter be infinite?

Step	Perimeter
Initial Figure (Step 0)	3
Step 1	
Step 2	
Step 3	
Step 4	

($\boldsymbol{B}$) In each step pictured above, the Koch Snowflake is always pictured in a box of the same size. The box has a finite area. No matter how many times we apply the rule, this fractal always fits in the same size box. Is the area of the fractal finite or infinite?