

LAB 9

Geometric Series

Purpose To explore geometric series using geometric objects.

Introduction

In lecture you have learned how to sum a geometric series. The general geometric series is given by

$$\sum_{n=0}^{\infty} ar^n = a + ar + ar^2 + \dots$$

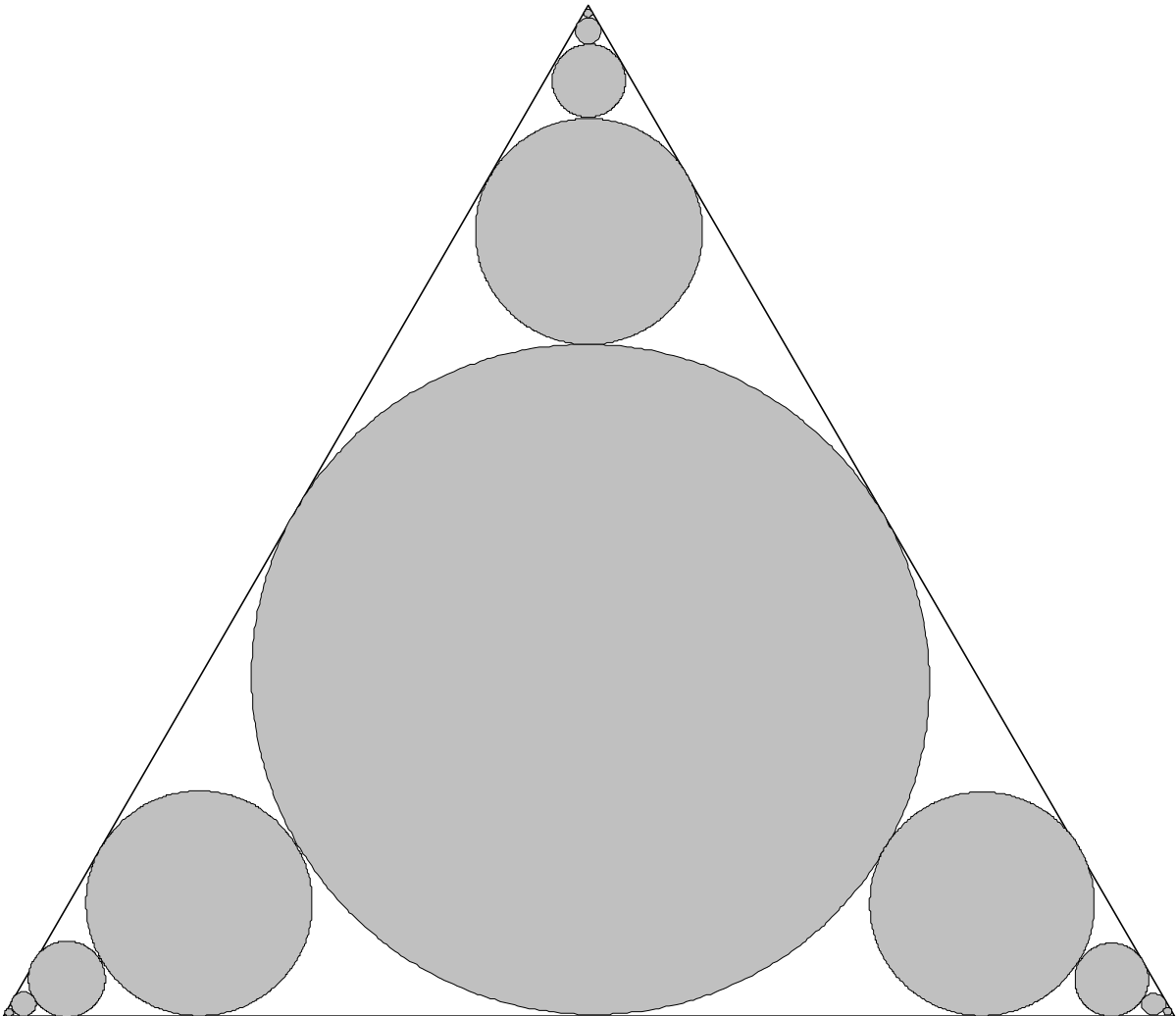
The series converges when the common ratio, r , satisfies $|r| < 1$. In this case, $\sum_{n=0}^{\infty} ar^n = \frac{a}{1-r}$.

You will explore several geometric figures that involve geometric series.

I. Infinite Snowman

Find the area of the shaded region: a) experimentally, b) as a formula in terms of the side a of the triangle. (See Problem # 68, page 722.)

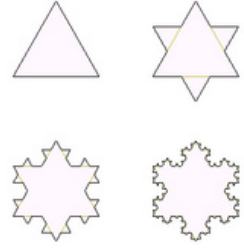
a) Ans= _____ b) Ans = _____



Names _____, _____

II. Koch Snowflake

A Koch Snowflake is constructed by starting with an isosceles triangle and successively adding smaller triangles scaled to $1/3$ the size to each edge. The figure on the right shows $N = 0, 1, 2,$ and 3 iterations of this procedure. Carrying out these iterations leads to an object known as a fractal. Fractals typically display self-similar behavior. Sections of fractals appear the same at all scales.



You are provided with large size models of these geometric objects for two different iterations.

1. What is the order of the iteration of the first model (Koch Flake 1) and what is the area?

Iteration = _____

Area = _____

2. What is the order of the iteration of the second model (Koch Flake 2) and what is the area?

Iteration = _____

Area = _____

3. Find the area as N goes to infinity.

Area = _____

4. Find the length of the perimeter of Koch 1.

Length = _____

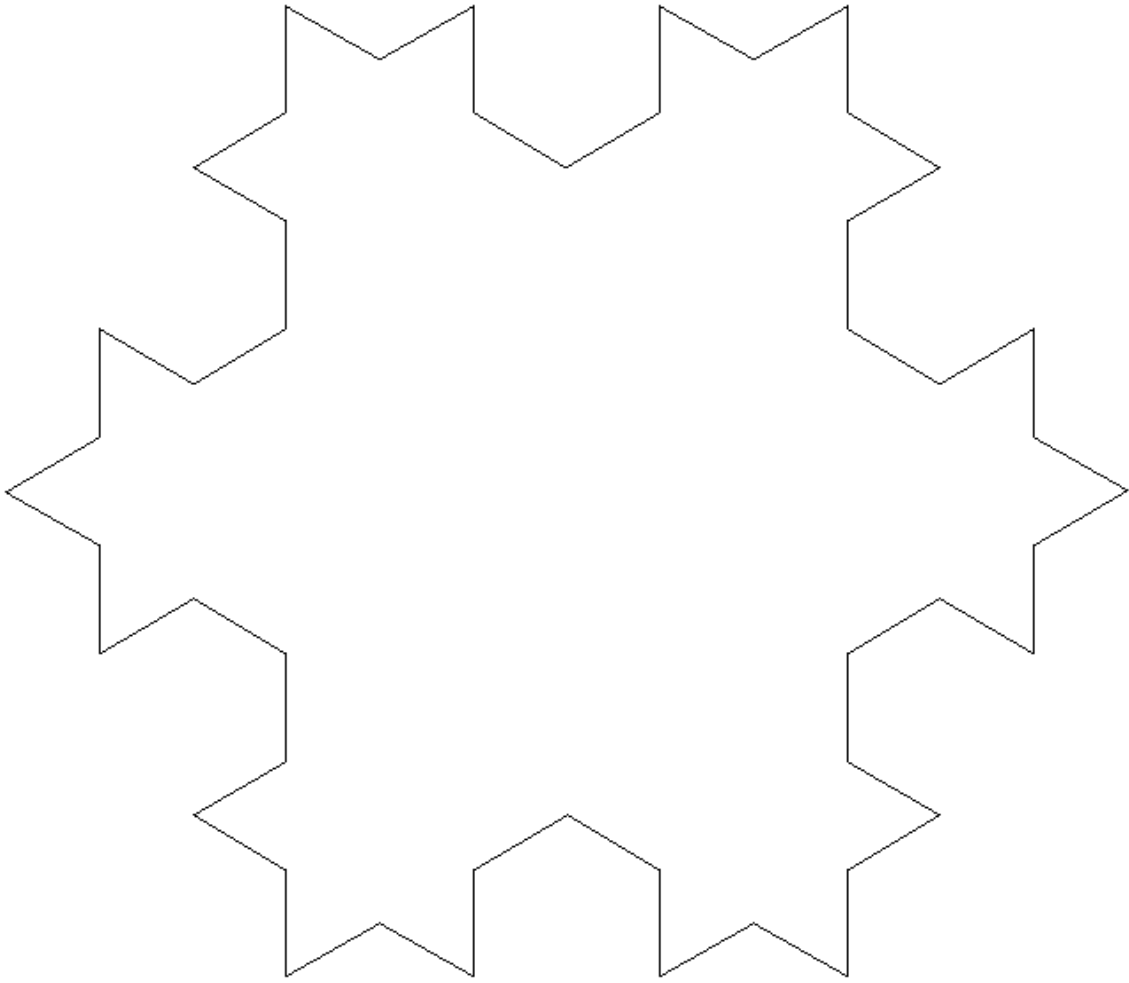
5. Find the length of the perimeter of Koch 2.

Length = _____

6. Find the total length of the Koch Snowflake as N goes to infinity.

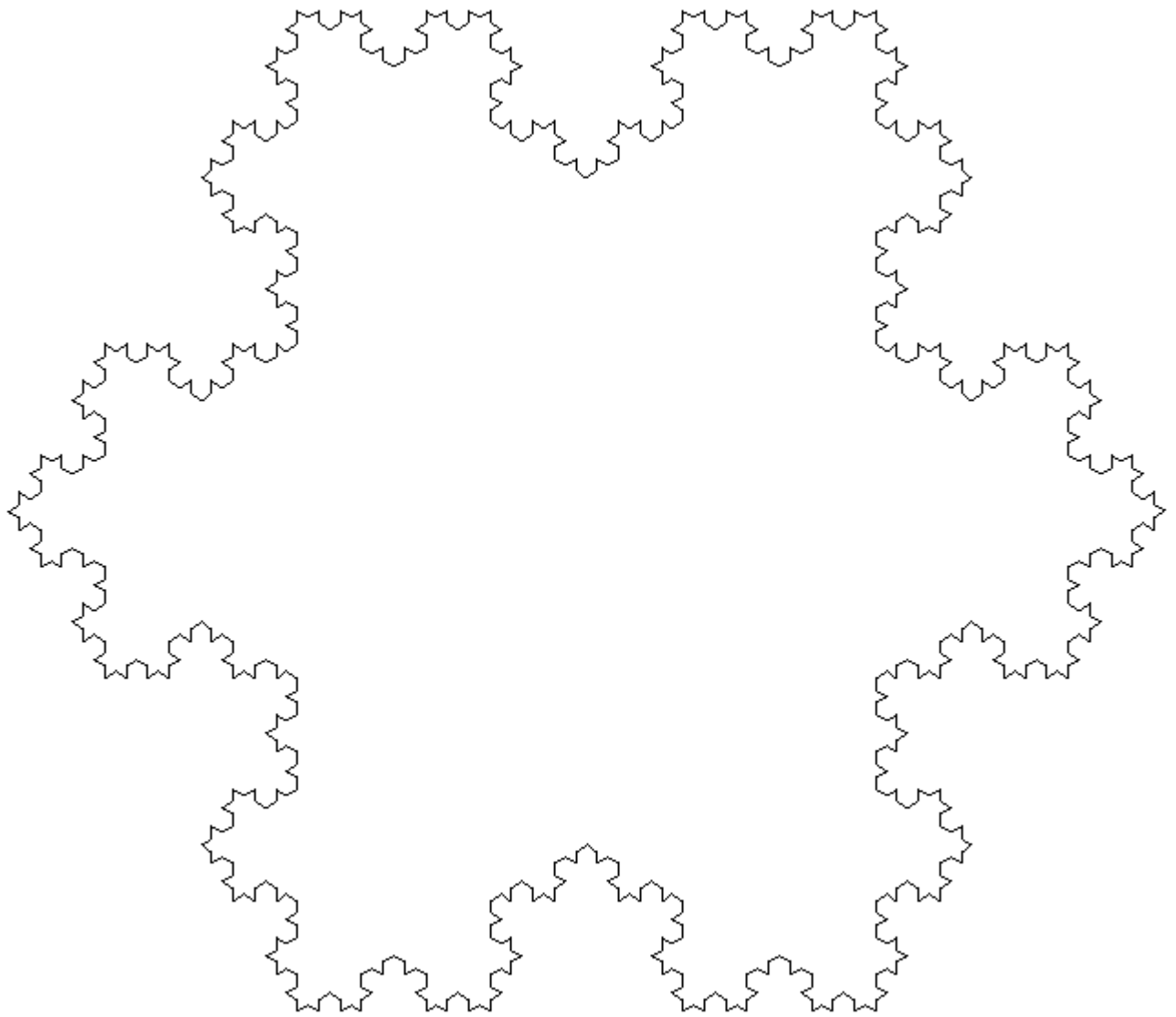
Length = _____

Names _____, _____



Koch Flake 1

Names _____, _____



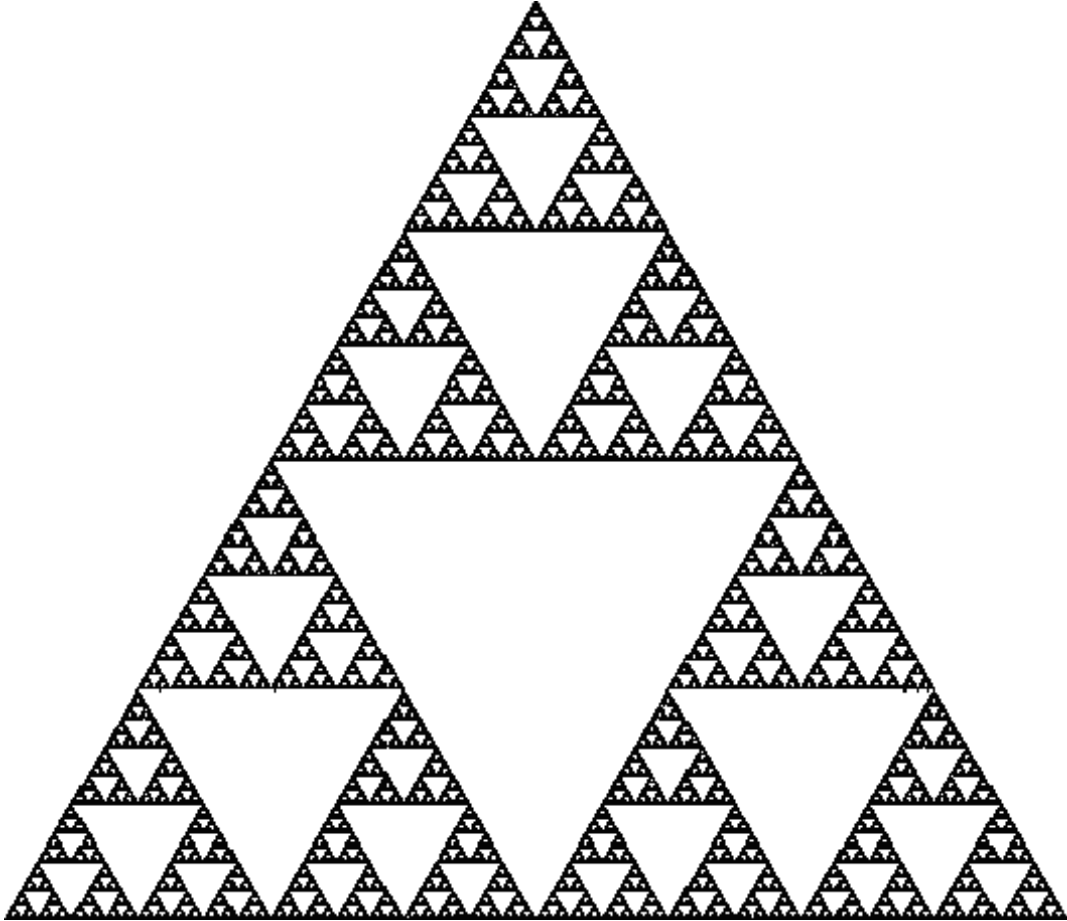
Koch Flake 2

Names _____, _____

III. Sierpinski Triangle

Give your best estimate of the shaded area below in cm^2 .

Ans: = _____



Names _____, _____

IV. More Circles - Bonus

Use geometric series to determine the total black area in the figure below.

