

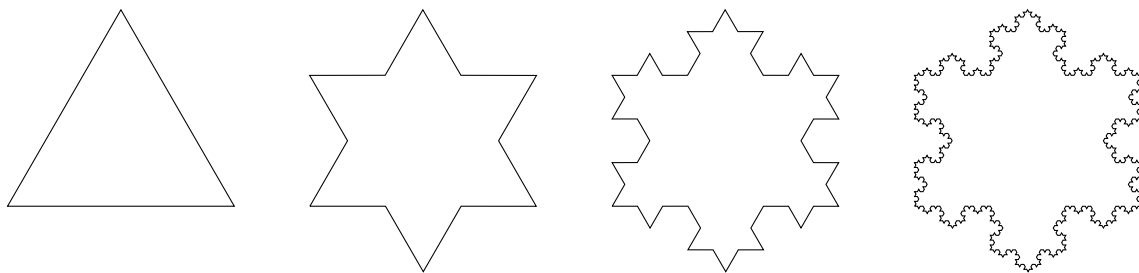
♣ Problem of the Week ♣

Prerequisites: Calculus 1

Note to current calc 1 students - You do actually have all the required prerequisites even though we haven't worked a question like this yet.

The perimeter of a geometric shapes can become difficult to calculate. Consider the following Koch snowflake (named after Helge von Koch). To create the snowflake do the following:

- Draw an equilateral triangle.
- On each face of the equilateral triangle replace the middle third of the line segment with an equilateral triangle. The Koch snowflake is obtained by continuing this process infinitely many times.



A German mathematician by the name of Felix Hausdorff devised a new numerical characteristic in order to classify such shapes. Typically, to measure the perimeter of smooth curves, you measure the length of each line segment (r) and count the number of line segments necessary to create the object ($N(r)$). The perimeter is then $N(r) * r$. With the Koch snowflake this formula diverges to infinity as r approaches zero. Hausdorff discovered a unique exponent $D > 1$ such that $N(r) * r^D$ remains finite but also larger than 0. Can you find the exponent D such that $0 < \lim_{r \rightarrow 0} N * r^D < \infty$?

Rules: This contest is open to Cumberland University students only. Solutions must be submitted by the deadline indicated. The first student to submit a correct answer **with supporting work** wins the prize (\$10.00). Any outside sources must be cited. **All work must be shown.** Work will initially be judged by Dr. Gammon. Disputes will be sent to another mathematician for a second opinion. Submit your solutions either typed in e-mail to kgammon@cumberland.edu or written legibly to Dr. Gammon, Memorial Hall room 310 A.