Mathematics 1120H – Calculus II: Integrals and Series
Trent University, Winter 2022
Assignment #8
Limits and sums for an odd shape
Due on Friday, 18 March.
*(May be submitted on paper or via Blackboard.*)*

Please show all your work. As with all the assignments in this course, unless stated otherwise on the assignment, you are permitted to work together and look things up, so long as you acknowledge the sources you used and the people you worked with.

Consider the following process:

Step 0: In the beginning we have an equilateral triangle with sides of length 1.

Step $n + 1$: Take the shape you have at the end of Step n and replace each straight segment of the perimeter by five segments of one-third of the length, arranged to add a small square to the area of the old shape in the middle of the old line segment.

The diagram below shows you what you have at the end of Steps $n = 0$, 1, and 2.
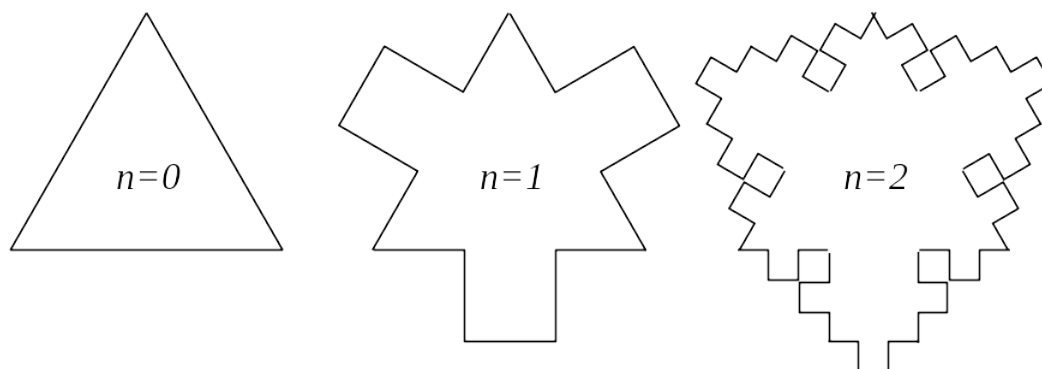
1. Find (and justify!) expressions in terms of n for the length of perimeter and the area of the shape at the end of Step n. These expressions should work for all $n \geq 0$. *[6]*

2. Compute the length of the perimeter and the area of the shape that one gets as the limit of the process. *[3]*

3. Just what is the shape that one gets at the limit of the process? *[1]*

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*   All else failing, please email your solutions to the instructor at: `sbilaniuk@trentu.ca`