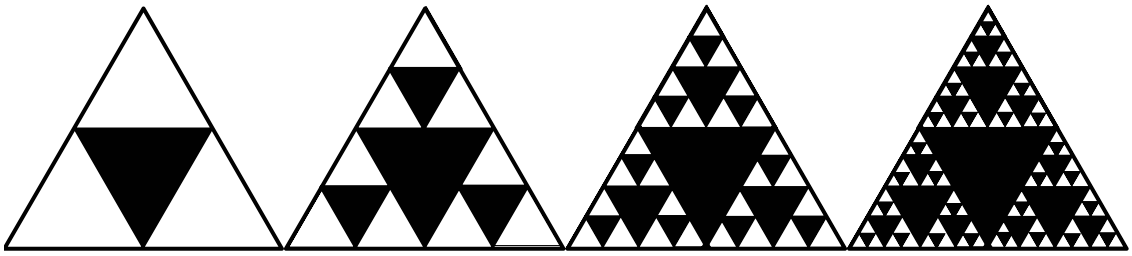
Exercise 1. Consider the series $\sum_{n=1}^{\infty} \frac{\sqrt{n^3}}{n^{5r}}$ where r is a real number and do the following:

I) Identify the general term of the series and simplify it.
II) Is our series a p-series? How can you justify that?
III) State the convergence result for p series. This means, given ANY p-series $\sum \frac{1}{n^p}$, for what values of p will that converge?
IV) Determine for which values of r will our series converge. [Hint: The answer to this item is NOT the same as the last item.]

Exercise 2 (Filling a triangle)**.** Consider an empty triangle of area A which we start filling with smaller triangles. The objective of this question is to determine if we can fill completely the triangle in question.



We start adding a triangle with area $a_1 = \frac{A}{4}$ in the middle, then the second step adds 3 triangles of area $\left(\frac{A/4}{4}\right) = \frac{A}{16}$. So in total we are adding an area of $a_2 = \frac{3A}{16}$.

i) In the third step, how many triangles do we add? What is the area of each of the new smaller triangles? In total how much area a_3 are we adding in the third step?
ii) Derive a formula for the area added a_n at the n^{th} step by considering how many triangles are we adding and the area of each of those new triangles.
iii) As a sequence, is a_n geometric? If it is, what's is initial term and common ratio?
iv) Consider the series $\sum_{n=1}^{\infty} a_n$, in terms of area, what does this series represent? What do the partial sums represent?
v) Write an expression for the partial sums of this series.
vi) Using the information above, determine if we fill up the triangle.