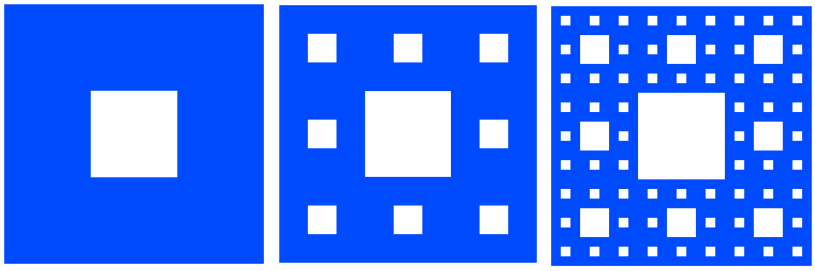
4. (8 points) The Sierpinski Carpet is an example of a mathematical object called a fractal. It is constructed by removing the center one-ninth of a square of side 1, then removing the centers of the eight smaller remaining squares, and so on. (The figure below shows the first three steps of the construction.)



At the $n$-th step of the process, $8^{n-1}$ squares are removed, each with area $\left(\frac{1}{9}\right)^n$. Thus, the area removed at the $n$-th step is $A_n = \left(\frac{8^{n-1}}{9^n}\right)$. There are infinitely many steps in the process.

(a) (2 pts.) Find the limit of the sequence $A_1, A_2, A_3, \ldots$.

(b) (2 pts.) Write a mathematical expression that represents $A$, the *total* sum of the areas of the removed squares after infinitely many steps of the process.

(c) (4 pts.) Exactly how much area is removed in all? Show your work.