A well done assignment is a joy to read! – hint!

1. In class today (Thursday 10/07/10) we discussed the Sierpinski Gasket – a fractal. We showed three things: its area is zero, its perimeter is infinite (unbounded) and its fractal (self-similar) dimension is \[
\frac{\log(3)}{\log(2)} = 1.58496
\]

The Sierpinski Carpet (the face of the Menger Sponge from Fig 11.22 page 80 of Maor) is generated by dividing a square into 9 sub-squares, removing the middle, repeating the process with the remaining 8 sub-squares, then doing the same to the remaining 64 sub-squares …

Stage 2 Sierpinski Carpet

As was done in class with the Sierpinski Gasket, do the following

A. Show the area of the Sierpinski Carpet is 0
B. Show the perimeter is infinite (unbounded)
C. Find the fractal (self-similar) dimension of the Sierpinski Carpet (including how you did it)

Show your calculations (and make them clear). Dot your i’s and cross your t’s. Make your explanations clear, concise, correct, and complete. Don’t assume the reader is knowledgeable in this area. Demonstrate that you understand the material and can explain it to someone else.
2. Also in class we discussed the Cantor Middle Third Set (CMTS) another fractal object whose fractal (self-similar) dimension is \( \frac{\log(2)}{\log(3)} = 0.6224 \). The CMTS was generated by taking out the open interval middle third \((1/3, 2/3)\) from the unit interval \([0,1]\) then repeating this by taking out the remaining middle thirds \((1/9, 2/9)\) and \((7/9, 8/9)\) etc.

We showed that the CMTS contained only points, no sub-intervals since its “length” was zero but it was not an empty set in that all endpoints of the sub-intervals remained.

There is something called the Cantor Middle Fifths Set (CMFS), similar to the CMTS except we divide the unit interval into fifths and take out the 2nd and 4th sub-intervals.

Do the following.

A. Elaborate on how you generate the CMFS

B. Show that like the CMTS, the CMFS contain only points, no sub-intervals since its length can be shown to be 0 yet it’s not empty since all endpoints of the sub-intervals remain.

C. Compute its fractal (self similar) dimension (including how you got it).

As was done in part 1 show your calculations (and make them clear). Dot your i’s and cross your t’s. Make your explanations clear, concise, correct, and complete. Don’t assume the reader is knowledgeable in this area. Demonstrate that you understand the material and can explain it to someone else.

Extra Credit: Can you come up with an addressing scheme for the CMFS similar to the addressing scheme for the CMTS – and use it to show the CMFT is uncountably infinite?

Finally

Hand in this assignment sheet (as a cover sheet) along with your assignment.

Feel free to make full use of your notes, text book materials and/or material from the course web-sites (but don’t go beyond!).