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# Pi and the Mandelbrot set

NEW: a PDF link to Dr. Aaron Klebanoff's proof of this result

For reference, look at the picture of the Mandelbrot set. If you turn it sideways so that left becomes up, you can imagine the shape of a person. The 2 areas I discuss below, the neck and the butt, become obvious.

I was trying to verify that the neck of the set (which is at (-.75,0) in the complex plane) is infinitely thin (it is). Accordingly, I was seeing how many iterations points of the form (-.75,X) went through before escaping, with X being a small number. Here's a table showing the number of iterations for various values of X:

| X | # of iterations |
|---|---|
| 1.0 | 3 |
| 0.1 | 33 |
| 0.01 | 315 |
| 0.001 | 3143 |
| 0.0001 | 31417 |
| 0.00001 | 314160 |
| 0.000001 | 3141593 |
| 0.0000001 | 31415928 |

Does the product of X and the number of iterations strike you as a suspicious number? It's pi, to within +- X. What the heck!

Let's try it again, this time at the butt of the set. The butt of the set occurs at (.25,0), and here's a table for points of the form (.25 + X, 0)

| X | # of iterations |
|---|---|
| 1.0 | 2 |
| 0.1 | 8 |
| 0.01 | 30 |
| 0.001 | 97 |
| 0.0001 | 312 |
| 0.00001 | 991 |
| 0.000001 | 3140 |
| 0.0000001 | 9933 |
| 0.00000001 | 31414 |
| 0.000000001 | 99344 |
| 0.0000000001 | 314157 |

proof) showing my result. Cool!

A few years later my original sci.math post was included in a book called Fractals For The Classroom, written by Peitgen, Jurgens, Saupe. A second book by the same group of folks also included the same material, including Dr Edgar's argument for showing that the result is pi. It is certainly one of the strangest places that pi crops up! Dr Edgar has some additional explanation and information on his web page on the same topic.