# MAD Week 4: Iteration

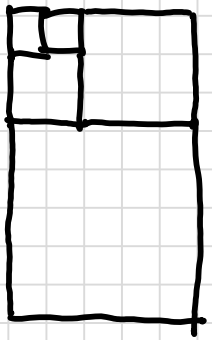
Note Title 4/14/2011

## Agenda/Goals

Get a good visual sense of the Fibonacci sequence

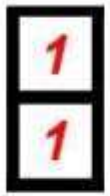
Practice iteration – both with numbers and visuals

Get a first glimpse of fractals



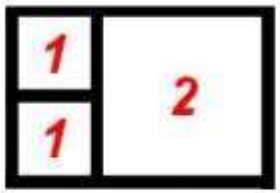
Short side of rectangle

1, 1, 2, 3, 5, 8, 13, 21,




1:2 or $\frac{1}{2}$ or $\frac{2}{1}$

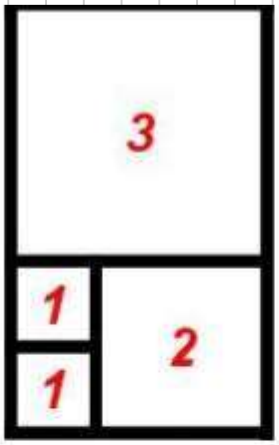
.5 2




2:3

$\frac{2}{3}$ $\frac{3}{2}$

.67 1.5



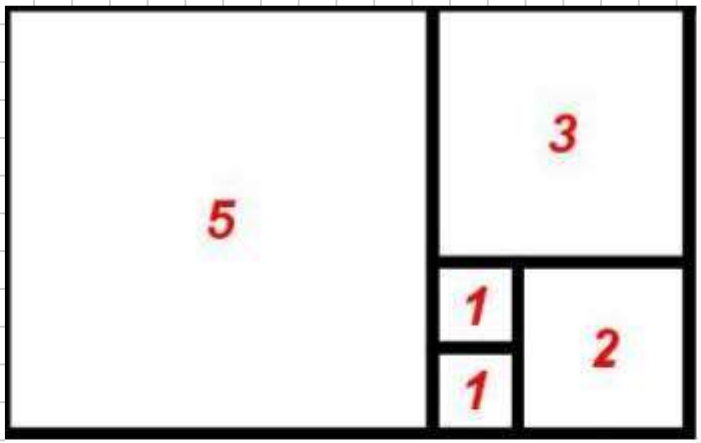

3:5

$\frac{3}{5}$

.6

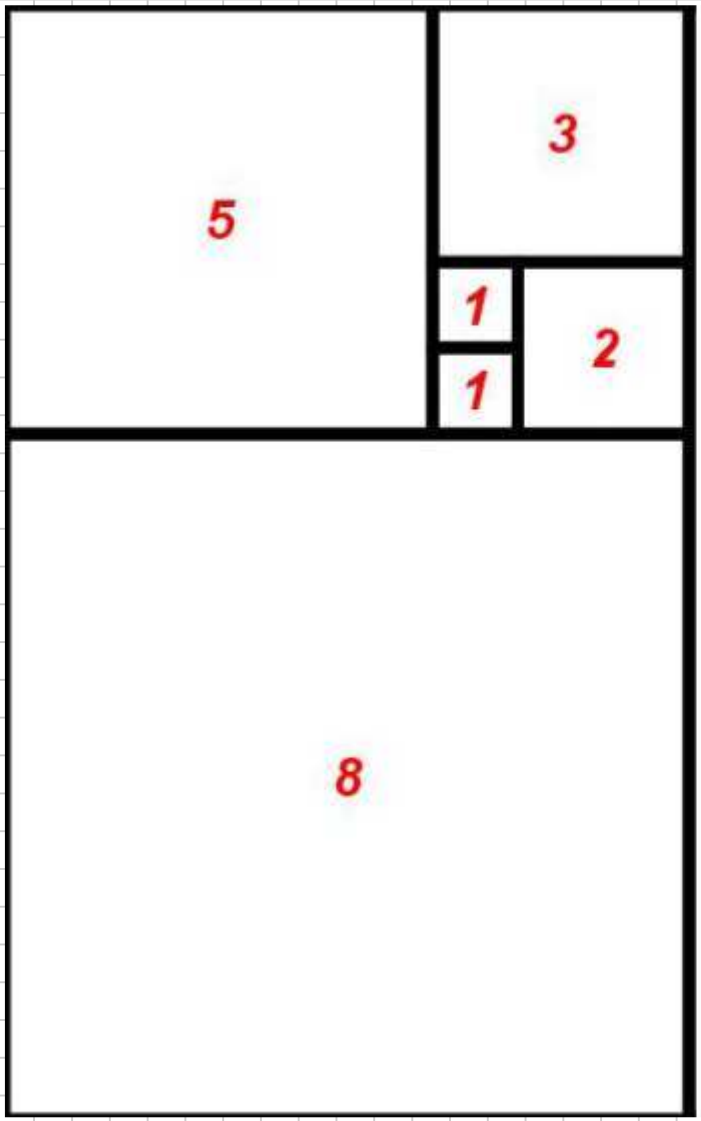
$\frac{5}{3}$

1.67




$5:8$ $\frac{5}{8}$ $\frac{8}{5}$

.628 1.6



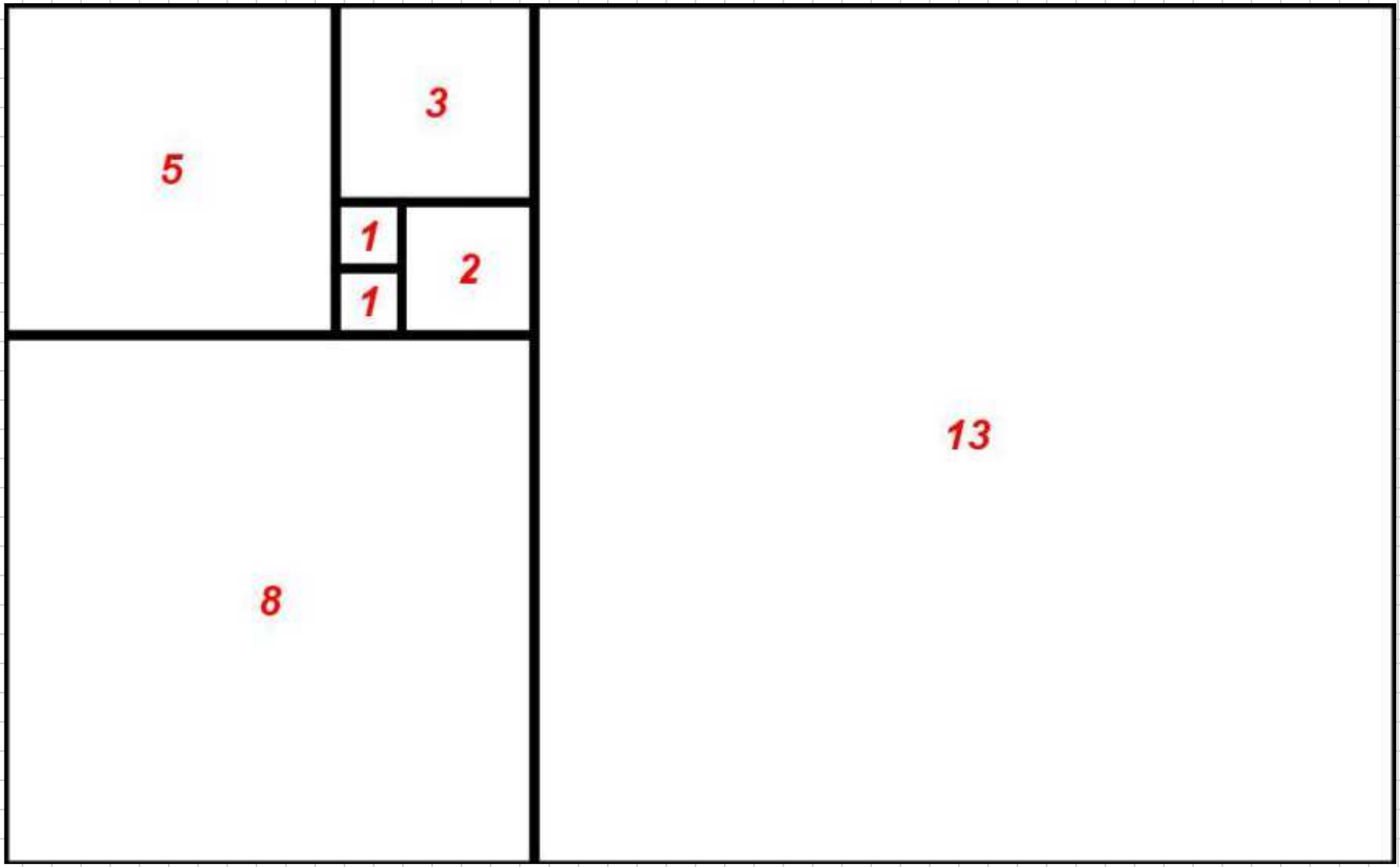

8:13

$\frac{8}{13}$

.615

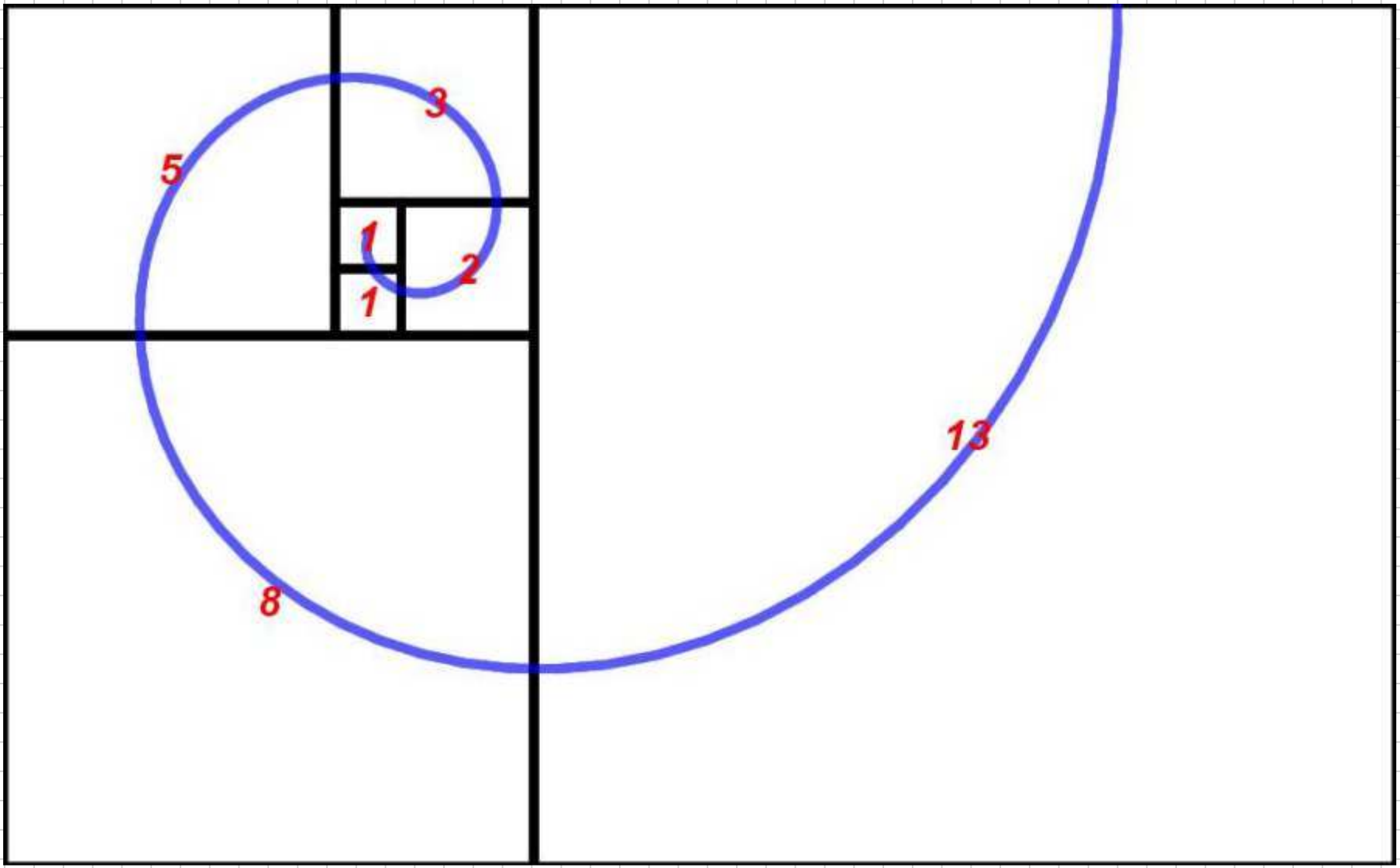
$\frac{13}{8}$

1.625

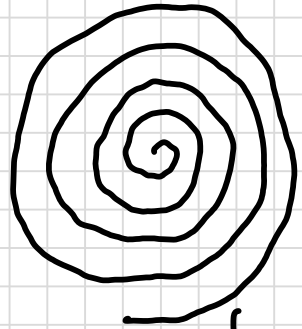



13:21

$\frac{13}{21} = .619$ $\frac{21}{13} = 1.616$


3
5
1
2
1
13
8

This is a kind of spiral known as a logarithmic spiral -

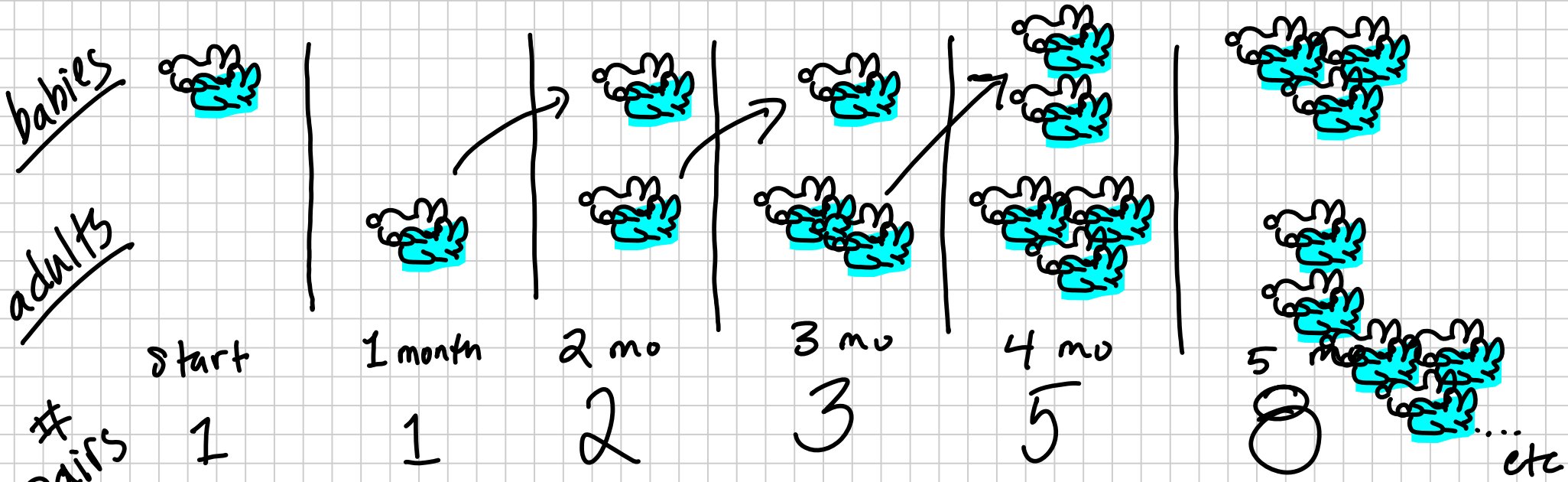


Archimedean spiral

This is our first fractal - it looks the same as we move out (and the pure mathematical creature is the same at any scale)

# "Thought Experiment": Rabbit Breeding

- Start with two newborn rabbits
- Takes one month for newborn pair to mature, then they start breeding
- Adult female has 1 M/F pair of babies each month
- Rabbits live forever!



# Fibonacci Sequence

1

1 ← seeds

1+1=2

1+2=3

2+3=5

3+5=8

5+8=13

8+13=21

21+13=34

rule: add two previous numbers to get next number

ITERATION

etc ...

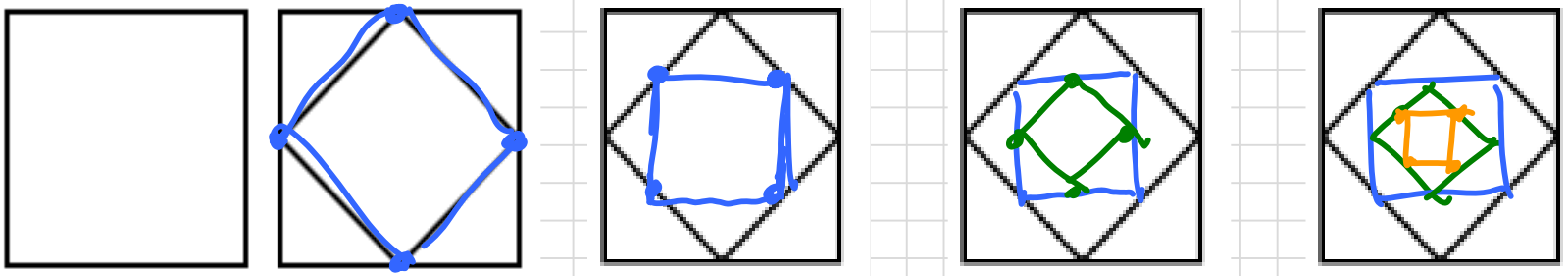
# Iteration

The act of repeating a process, where the results of one step ("iteration") are used as a starting point for the next step.

The fibonacci sequence is an example of iteration

$1, 1, 1+1=2, 2+1=3, 3+2=5,$ etc ...

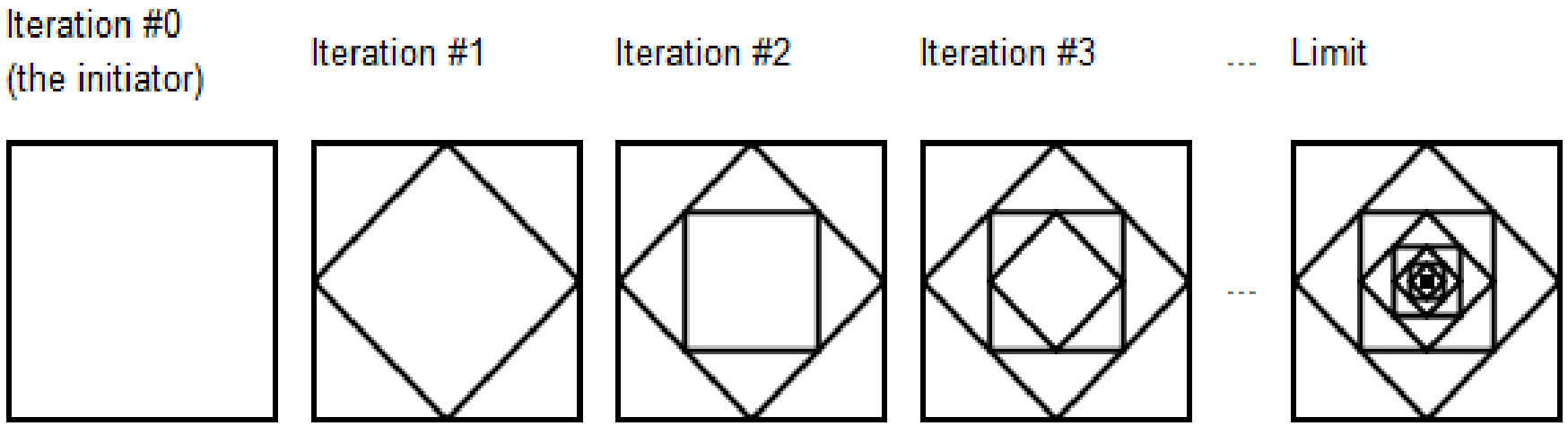
Another example of iteration:



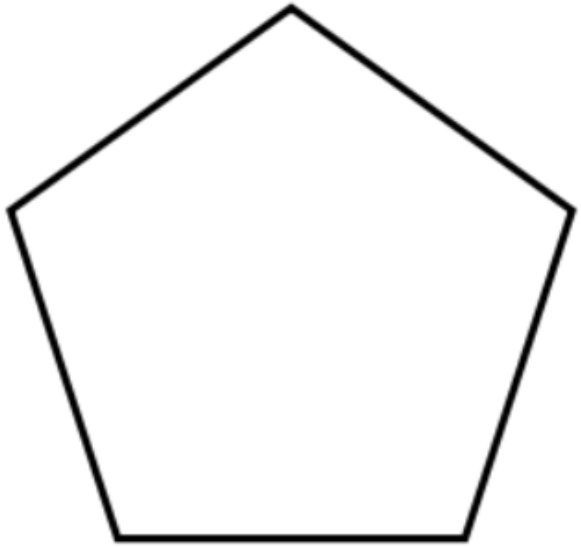
Stage: 0 1 2 3

Iterative step: Connect midpoints of sides of smallest square

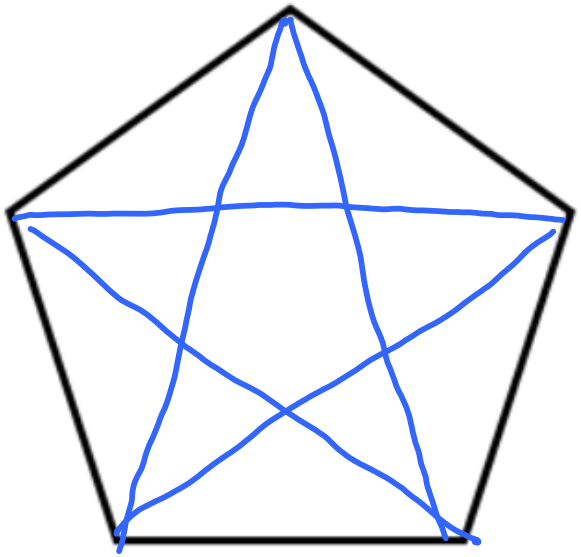
Continuing to iterate forever produces a limit pattern:



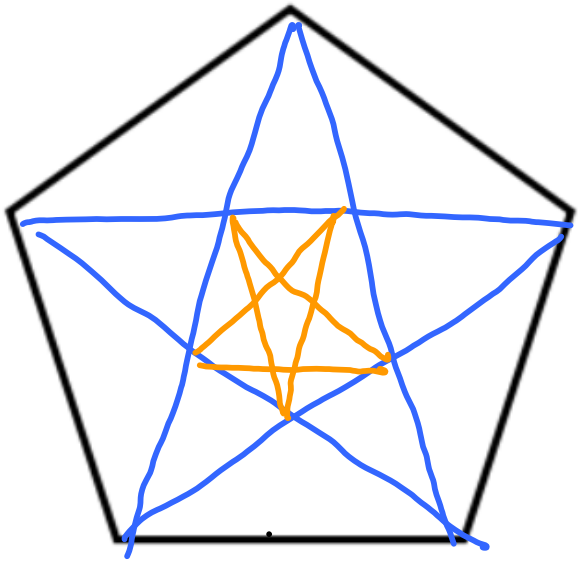

This limit is a fractal



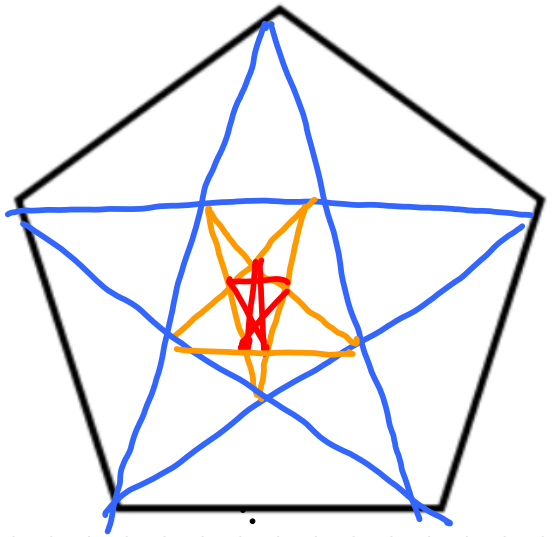
Iteration #0
(Start!)



Iteration #1



Iteration #2



Iteration #3