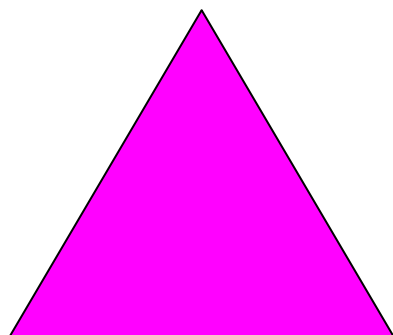


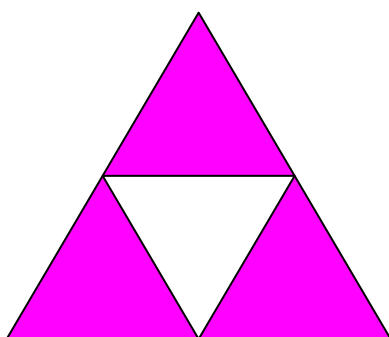
Sierpinski Triangle

If the area of the shaded region in Stage 0 is 1, find the area of the shaded region in the other stages.

$$\text{Area} = 1$$

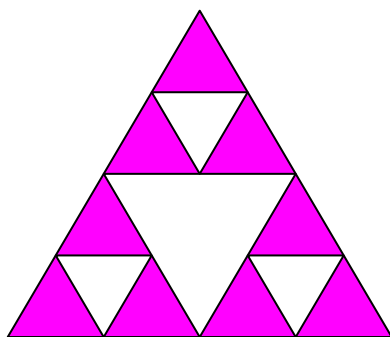


Stage 0



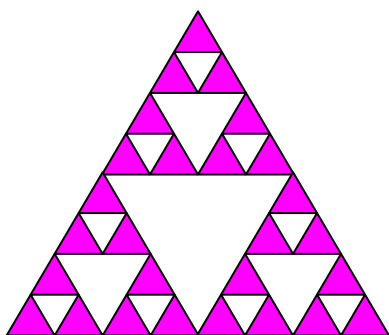
Stage 1

$$\text{Area} =$$



Stage 2

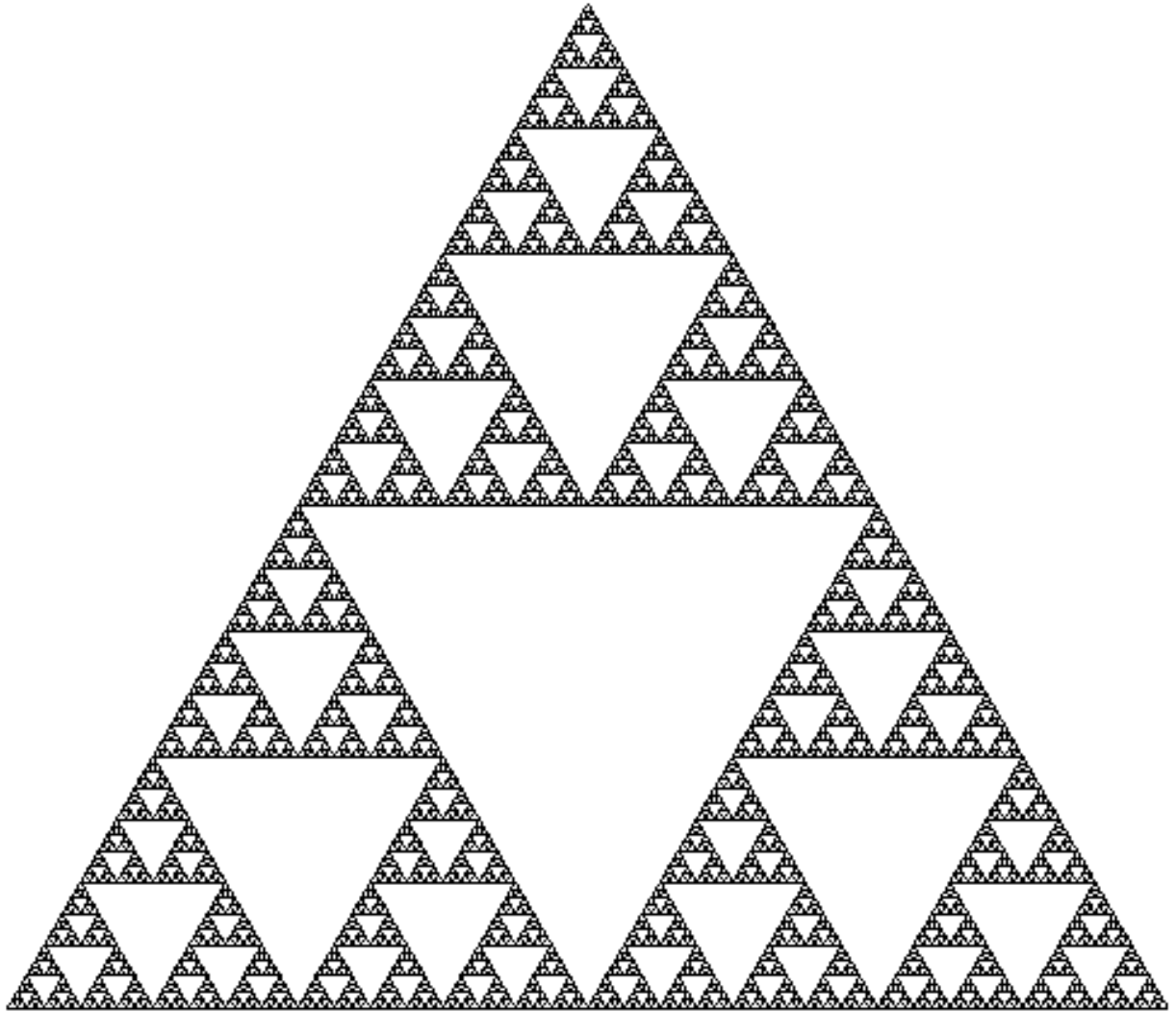
$$\text{Area} =$$



Stage 3

$$\text{Area} =$$

Sierpinski Triangle

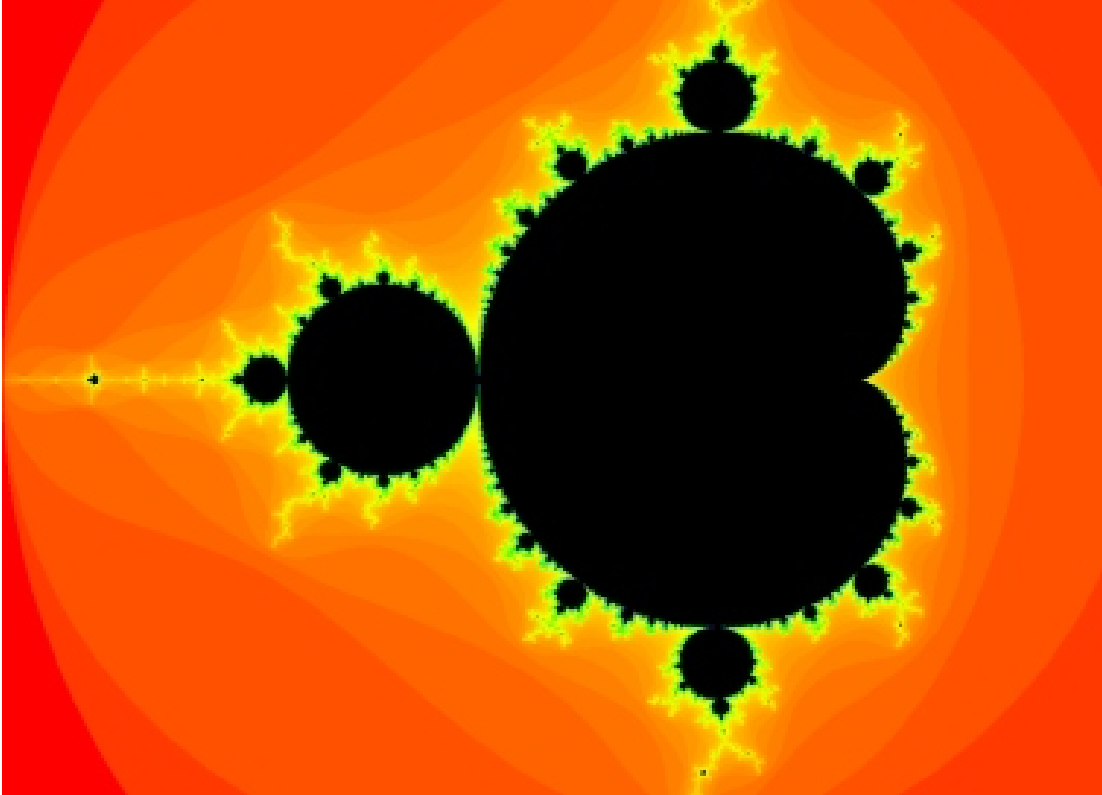


Sierpinski Pyramid



Postage stamp issued by Hungary in 1996 on the occasion of a Mathematical Congress held in Hungary.

Mandelbrot Set



Fractal Landscape





Atlas

Reverse Dictionary


Rhyming Dictionary

Collegiate® Dictionary

Collegiate® Thesaurus

Unabridged

One entry found for **fractal**.

Main Entry: **frac·tal** 

Pronunciation: 'frak-t&1

Function: *noun*

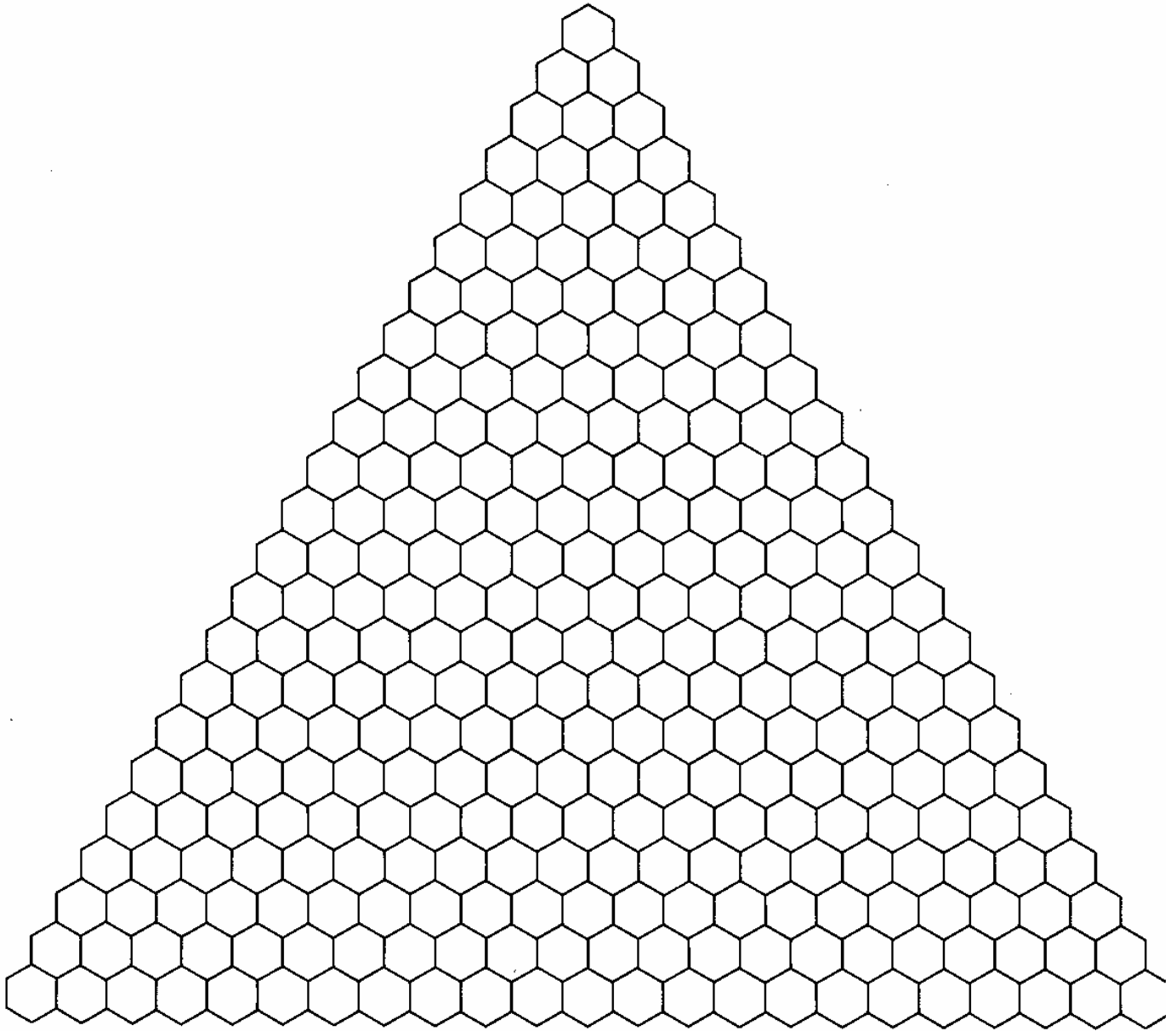
Etymology: French *fractale*, from Latin *fractus* broken, uneven (past participle of *frangere* to break) + French *-ale -al* (noun suffix)

Date: 1975

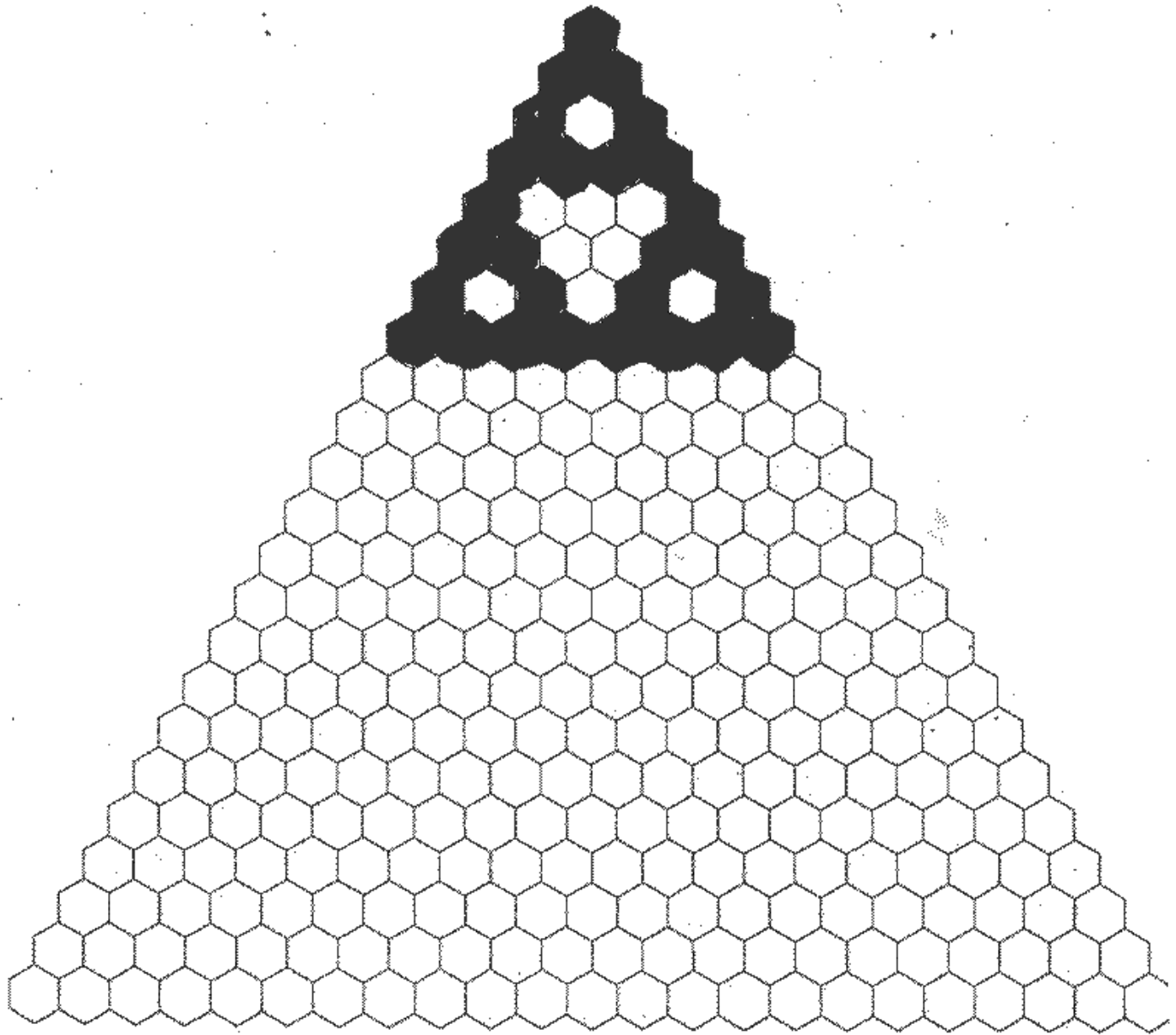
: any of various extremely irregular curves or shapes for which any suitably chosen part is similar in shape to a given larger or smaller part when magnified or reduced to the same size

- **fractal** *adjective*

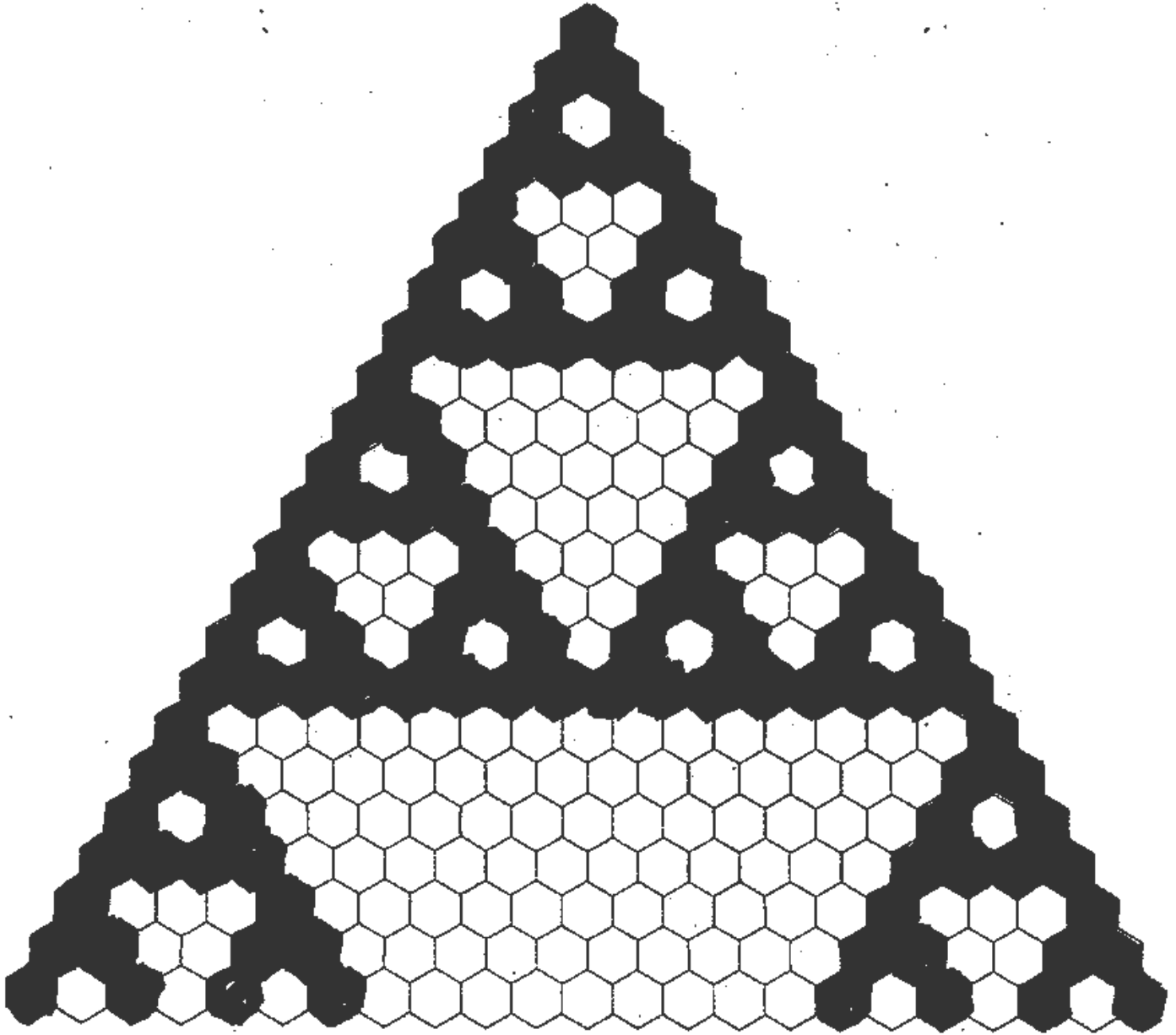
Group Project: Fill in using numbers from Pascal's Triangle, then color in each polygon that contains an odd number.

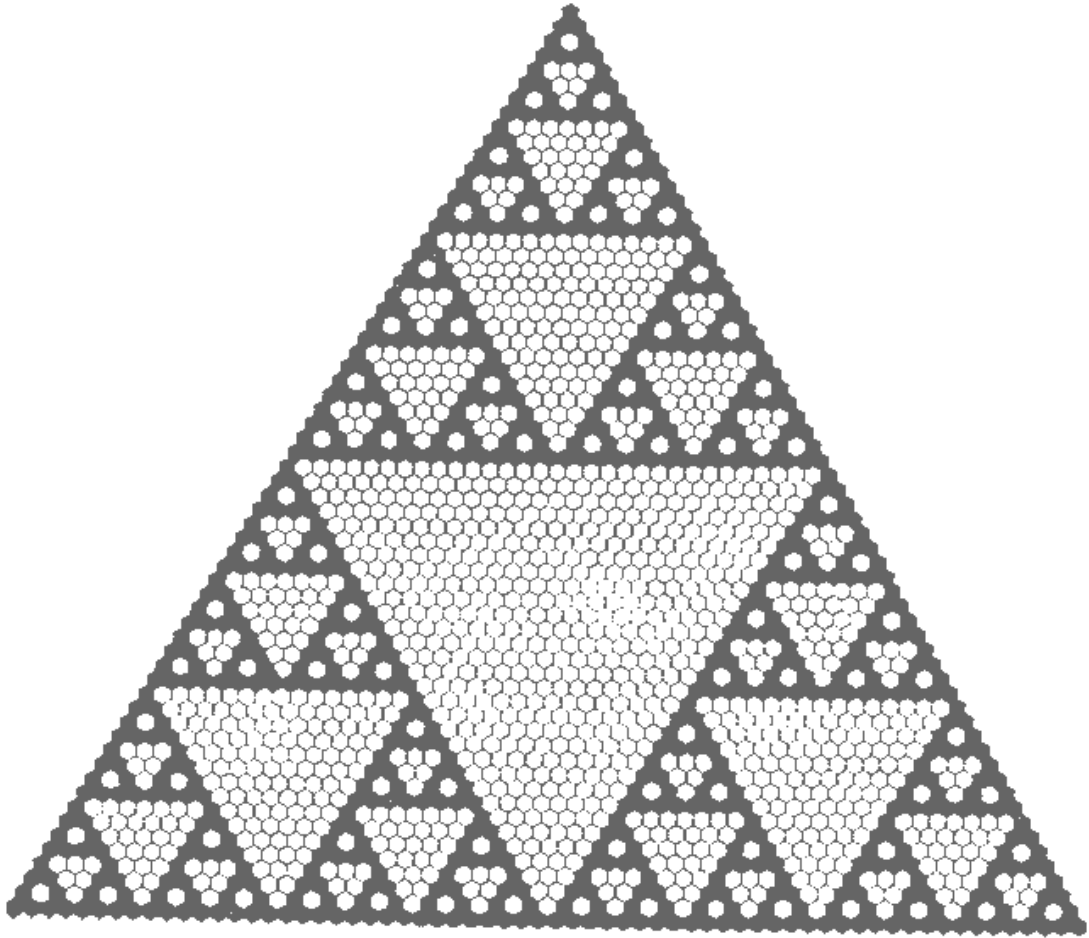


Pascal's Triangle



Pascal's Triangle





Iterated Functions

Definition: If x is in the domain of a function f , then the sequence below is called an *orbit* of x for f . Each member of the sequence is called an *iterate* of x for f .

$$x, f(x), f(f(x)), f(f(f(x))), \dots$$

A Regular Function

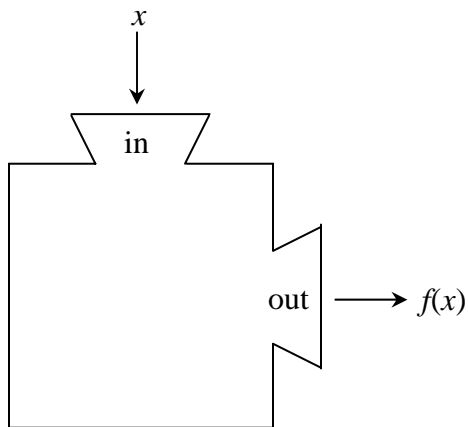


Figure 1

An Iterated Function

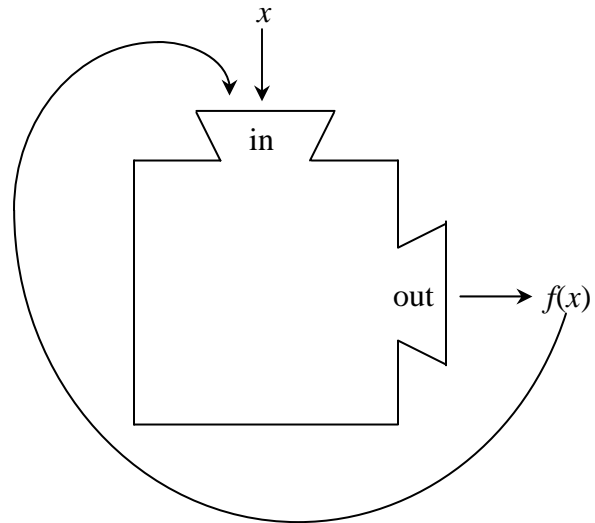


Figure 2

EXAMPLE Write the orbit of 0 for $f(x) = \sqrt{1 + x^2}$.

First iterate: $x = 0$

Second iterate: $f(0) =$

Third iterate: $f(f(0)) =$

Fourth iterate: $f(f(f(0))) =$

Fifth iterate: $f(f(f(f(0)))) =$

EXAMPLE Write the orbit of 2 for $f(x) = 1 + \frac{1}{x}$.

First iterate: $x = 2$

Second iterate: $f(2) =$

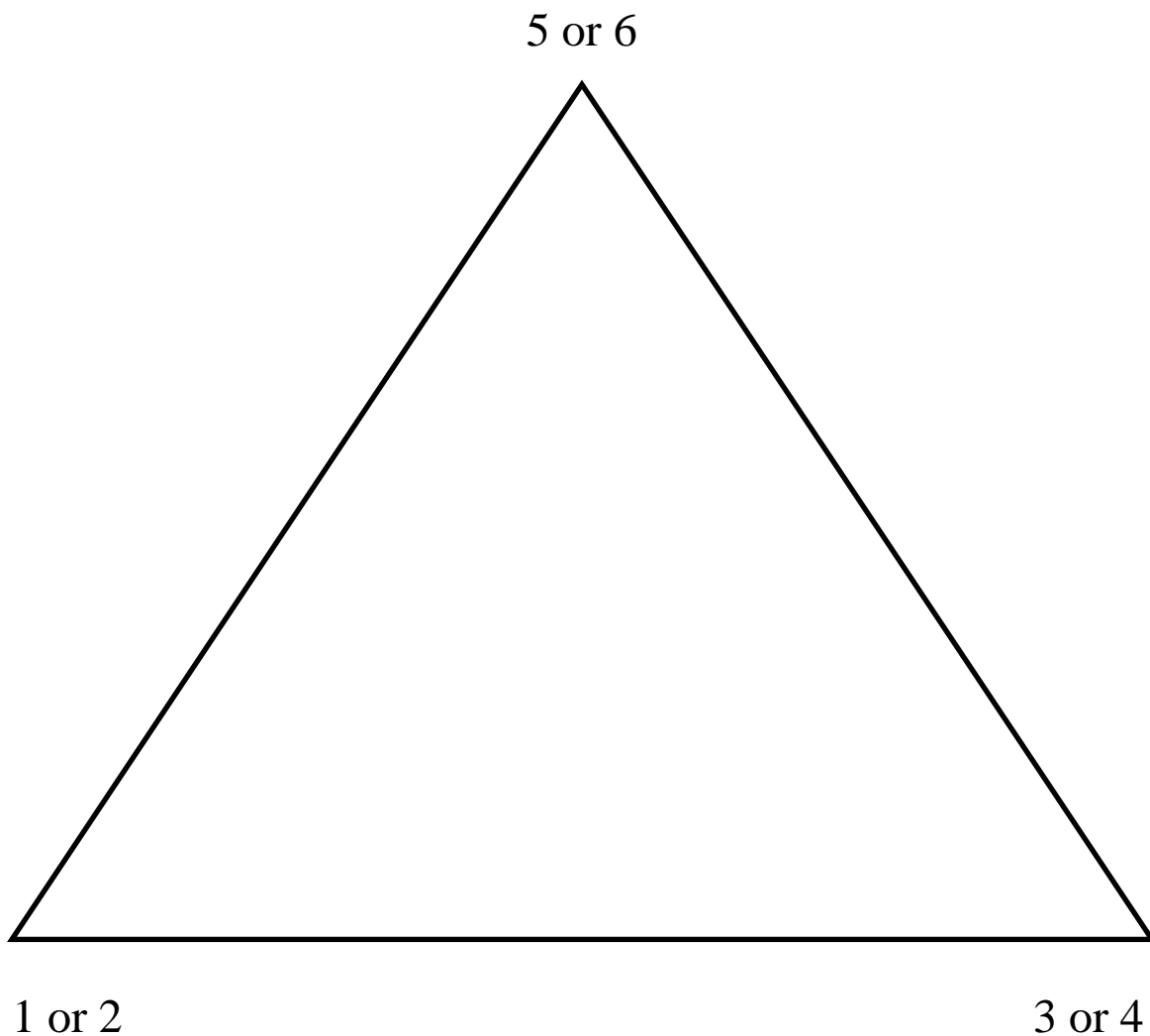
Third iterate: $f(f(2)) =$

Fourth iterate: $f(f(f(2))) =$

Fifth iterate: $f(f(f(f(2)))) =$

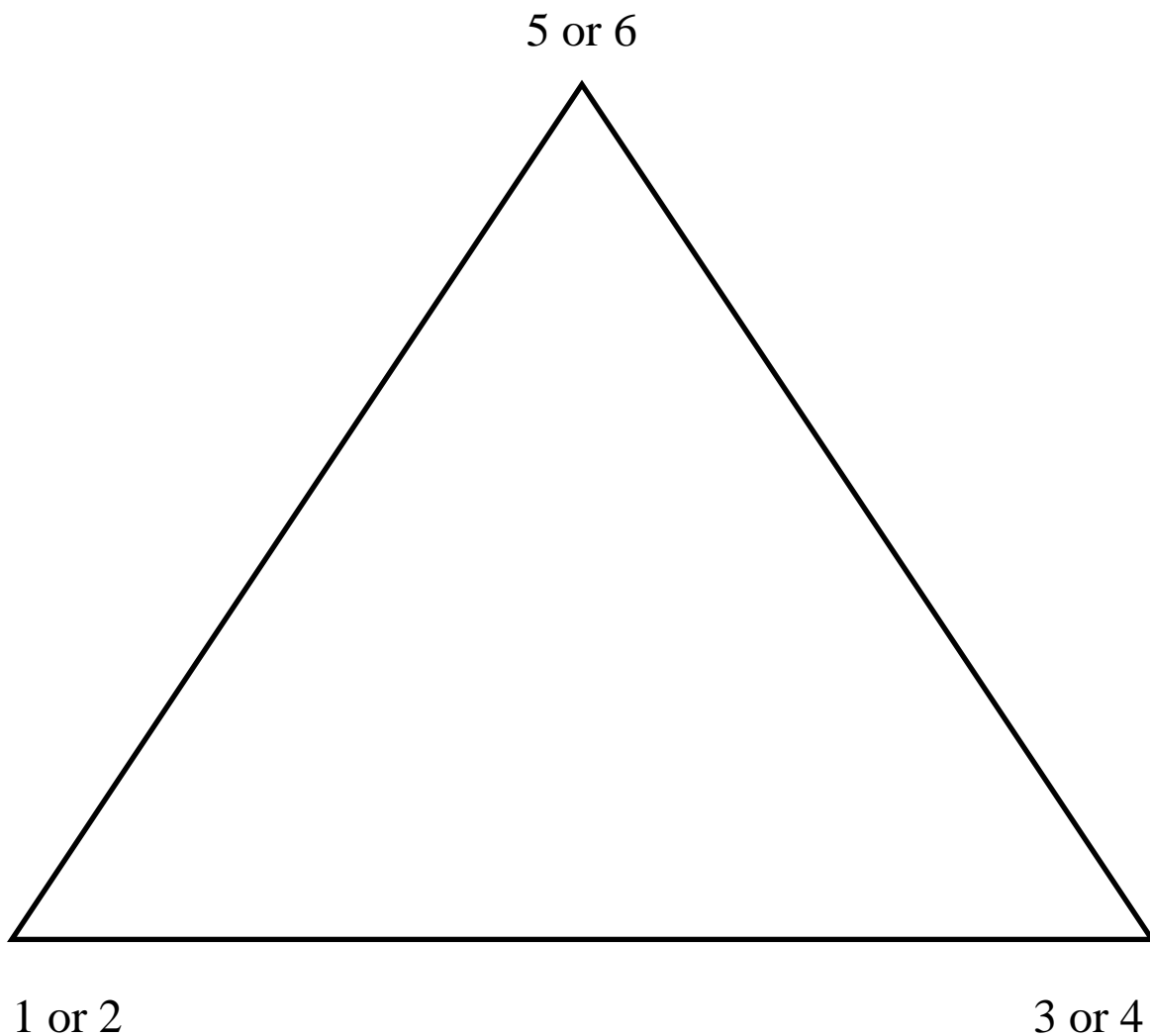
The Chaos Game - Lines

- Step 1. Pick any point within the triangle as the starting point.
- Step 2. Roll a die. The number that appears will indicate which vertex you are to move toward.
- Step 3. Draw a line segment from your starting point to the point that is halfway to the indicated vertex.
- Step 4. The point halfway to the vertex is your new starting point. Go to Step 2 and repeat the process.



The Chaos Game - Dots

- Step 1. Pick any point within the triangle as the starting point.
- Step 2. Roll a die. The number that appears will indicate which vertex you are to move toward.
- Step 3. Place a dot at the point that is halfway to the indicated vertex.
- Step 4. The point halfway to the vertex is your new starting point. Go to Step 2 and repeat the process.



Chaos Game on the TI Graphing Calculator

The program below plays the Chaos game with line segments. It is just a matter of changing one line to get the Chaos game with points instead of line segments. When I do this in class, I have both versions of the game programmed into the calculator.

Note that I use variables C and D instead of X and Y in the program. When I use Y in place of D, I get some lines and points that seem like they are wrong.

```
:FnOff
:PlotsOff
:GridOff
:ClrDraw
:0→Xmin
:1→Xmax
:0→Ymin
:1→Ymax
:Disp "X="
:Input C
:Disp "Y="
:Input D
:Pt-On(C,D)
:For(K,1,1500)
:C→A
:D→B
:randInt(1,3) →N
:If N=1
:Then
:.5C→C
:.5D→D
:End
:If N=2
:Then
:.5(C+1)→C
:.5D→D
:End
:If N=3
:Then
:.5(C+.5)→C
:.5(D+1)→D
:End
:Pt-On(C,D)
:Line(A,B,C,D)
:End
```

I'm not sure if all of these first four lines are necessary.

You can replace these four lines with $.5 \rightarrow C$ and $.5 \rightarrow D$ if you want the program to run without inputting the first point.

Delete this line to get just points instead of lines.