# Fractal Triangles
*Teacher's Intro*

## OVERVIEW

The Sierpinski Triangle activity illustrates the fundamental principles of fractals - how a pattern can repeat again and again at different scales, and how this complex shape can be formed by simple repetition.

Each student will make their own fractal triangle, in which they make smaller and smaller triangles. Then, they will cut out their triangles and assemble them all into a larger, fractal pattern that replicates the same shape.

Required: Markers or crayons, and scissors.

## NM Math Standards:

(K,1,2).A.1.3 Recognize, reproduce, describe, extend, and create repeating patterns.
4.A.1.2 Create and describe numeric and geometric patterns including multiplication and division patterns

3.A.3.2; 4.A.3.1 Solve problems involving proportional relationships
2.G.4.4 Relate geometric ideas to numbers
2.D.1.1 Collect numerical data systematically
2.M.2.3 Estimate measurements and develop precision in measuring objects.

3.G.4.1 Visualize, build, and draw geometric objects

4.G.1.1 Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes:
    a. build, draw, create, and describe geometric objects
    c. identify and compare congruent and similar figures

4.G.1.3 Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions

5.A.1.3 Identify, describe, and continue patterns presented in a variety of formats

5.D.1.1 Construct, read, analyze, and interpret tables, charts, etc

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Print out the activity template (next page) and make enough copies for each student to have their own.

Give the students markers or crayons, and instruct them to connect the midpoints to make a new, downward-facing triangle. Have them color in the downward-facing triangle only. This will leave three upward-facing triangles remaining, each of which is like the original, but half the width (A). Have them place dots at the midpoints of each of the sides of each of the three smaller triangles. Connect those midpoints to make three smaller downward facing triangles, and then color in these triangles (B). Repeat the same process again for at least 3 iterations total (C)
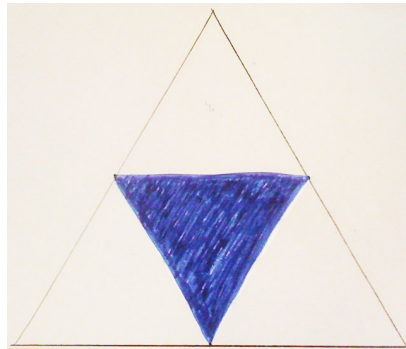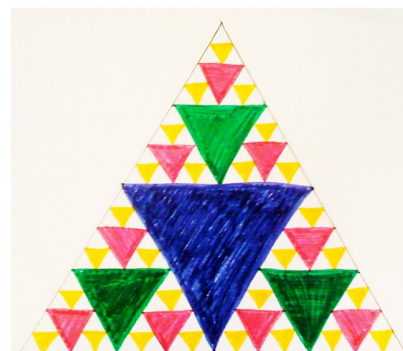

A
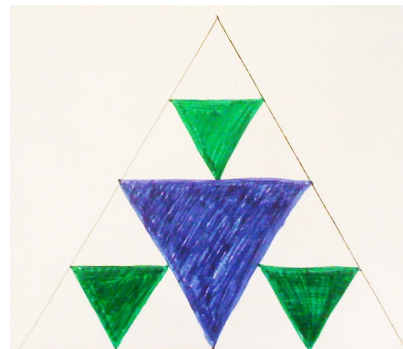

B
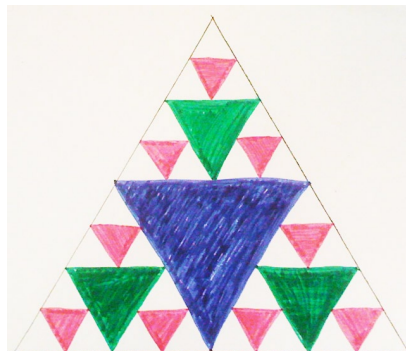

C


D

Rubric for evaluation: They must get to at least step B. Does their triangle there any self similarity, or just lots of copies of one size of triangle? How accurate are their midpoints? Allow for creative expression - each student's fractal is an individual artwork - but they must be fractal.

When they're all done, have them join their triangles into groups to form a larger version of the same shape!  9, 27, or 81 triangles works best.

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# Fractal Triangle Template

## Instructions:

The three dots on the sides of the triangles are called the "midpoints" of the sides, and they are half way from one corner to the other.

Connect the dots to make a new triangle that points downward.

Color in this downward triangle.

There are then 3 triangles left over. Find the midpoints of the 3 sides of these 3 triangles, and place dots there. Connect these midpoints to make 3 smaller, downward facing triangles.

Continue the same process, making smaller and smaller triangles. For each cycle - or iteration - count the number of upward triangles, and fill in the number in the table.

Do at least 3 iterations, but fill in all the values in the table, up to the 5th.

| Iteration | Number of Triangles |
|-----------|---------------------|
| 0 | 1 |
| 1 | 3 |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

Fractals are never-ending patterns, and you could keep doing this for a long time. Forever, perhaps.

When you decide you're done, cut out the big triangle, flip it over, and write your name and school on the back. Join it with others to make groups of 3, 9, 27 or more triangles that make the same shape, but larger.

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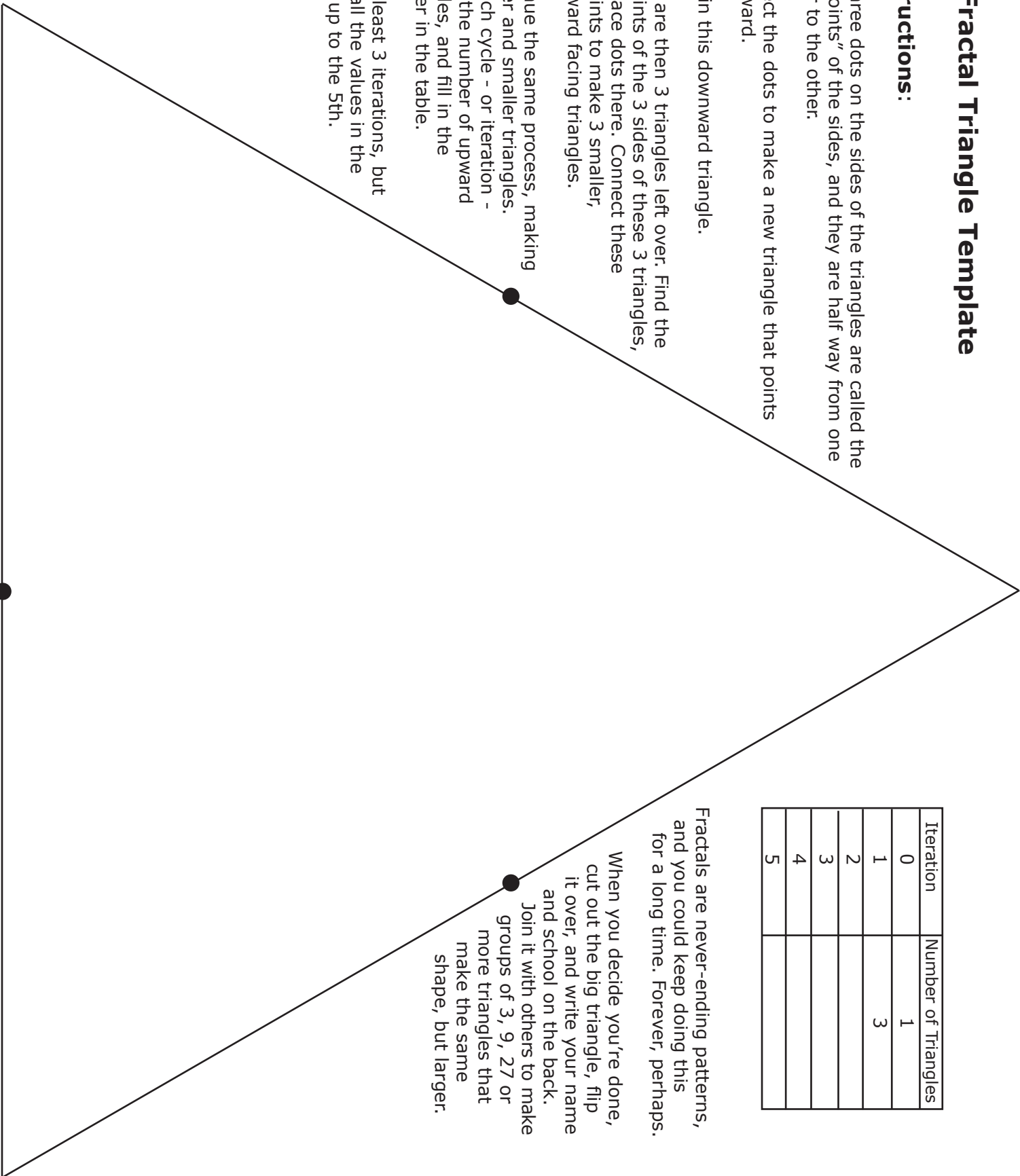
# Fractal Triangles
*Student Exercise*

**Problem:** You are about to build the world's largest fractal triangle, made out of 2187 triangles. To do so, you must lay down masking tape on the floor to draw the outlines, so you know where to put all the triangles. The entire triangle is 96 feet on a side. Each of the smallest triangles in the diagram is 12 feet wide.

**How much masking tape will you need?** _____

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