## Fractal Triangles

## 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 composed of smaller and smaller triangles. Next, students will cut out their personalized triangles and assemble them all into a larger fractal pattern that replicates the same shape.


Appropriate for: grades $\mathrm{K}-12$, college and adults

## Objectives

- To create a complex pattern by repeating a simple process over and over again
- To compose, describe and identify shapes and patterns
- To analyze and compare shapes according to properties of their lines and angles
- To use operations to explain patterns in arithmetic and create mathematical models
- To attend to precision
- To exhibit teamwork when using each student's individual fractal design to make a larger product
- To produce a piece of art that expresses each student's individuality
- To use appropriate tools strategically


## Materials

- Markers, colored pencils or crayons
- Scissors
- Ruler/straight edge (optional)
- Ruler and protractor for older grades
- Triangle worksheet


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## Common Core Standards for Mathematics

| Code | Standard | Grade | Code | Standard | Grade |
| :--- | :--- | :--- | :--- | :--- | :--- |
| CC | Counting and Cardinality | K | G | Geometry | K-8 |
| NBT | Number and Operations in | K, 1 | NS | Number System | 6,7 |
|  | Base Ten |  |  | Ratios and Proportional | 6,7 |
| OA | Operations and Algebraic <br>  <br> Thinking | K-5 | RP | Relationships <br> MD | Measurement and Data |

Common Core Standards for English Language Arts

| Code | Standard | Grades K - 5 | Grades 6-8 | Grades 9-12 |
| :--- | :--- | :--- | :--- | :--- |
| RL | Reading: Literature | $1,4,7,10$ | $1,4,7,10$ | $1,4,10$ |
| RI | Reading: | $1,3,4,7,10$ | $1,3,4,7,10$ | $1,3,4,10$ |
|  | Informational Text |  |  |  |
| FS | Foundational Skills | $1,2,3$ for grades K - 1; 3 | None available | None available |
|  |  | and 4 for grades 2-5 |  |  |
| W | Writing | $2,3,8 ; 4$ for grades 3-5 | $2,3,4$ | $2,3,4,9$ |
| SL | Speaking and | $1,2,3,4,5,6$ | $1,2,3,4,5,6$ | $1,2,3,4,5,6$ |
|  | Listening |  |  |  |
| L | Language | $1,4,6 ; 3$ for grades 2-5 | $1,3,4,6$ | $1,3,4,6$ |
| RST | Science and | None available | $1,3,4,6,7,10$ | $2,3,4,6,7,10$ |
|  | Technical Subjects |  |  |  |

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## Instructions

Print out one activity template (page 5) for each student.
1.) Provide markers, colored pencils or crayons and instruct students to connect the midpoints of the existing triangle to make a new, downward-facing triangle. Have students 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.
2) Next, have students 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.

3 and 4) Repeat the same process again for at least three iterations total.


Rubric for evaluation: They must get to at least step 2. Does their triangle exhibit selfsimilarity, or is it 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.

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When students are done, each student should cut out their triangle and then join their triangles in groups to form a larger version of the same shape! Nine, 27, or 81 triangles work best.
"Triangle handout" is the companion worksheet for this activity.


Fractals are SMART: Science, Math \& Art!

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