**Sierpinski’s Triangle**

Sierpinski’s triangle is one of the most famous fractal designs. In this activity we explore the fraction of the original equilateral triangle which remains unshaded as the stage number increases, and the sum of the perimeters of the triangles added at each stage as the stage number increases. Below are the first three stages of Sierpinski’s triangle.



 **Stage 0 Stage 1 Stage 2**

1. On a large equilateral triangle, draw stage 5 of Sierpinski’s triangle.
2. Determine the fraction of the large triangle which remains unshaded for each stage below. For each fraction, identify the equivalent decimal number.

|  |  |  |
| --- | --- | --- |
| **Stage Number** | **Fraction Unshaded** | **Decimal Equivalent** |
| 0 | 1 | 1.00 |
| 1 | ¾ | 0.75 |
| 2 | 9/16 |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

1. Find a recursive rule for the fraction of the large triangle that is unshaded at any stage.
2. Find an explicit rule for the fraction of the large triangle that is unshaded at any stage.
3. What fraction of the large triangle is unshaded at stage 10?
4. Assume that the large triangle in Stage 0 has a side length of 1 unit.
5. What is the length of each side of the shaded triangle in Stage 1? Explain.
6. What is the perimeter of the shaded triangle in Stage 1? Explain.
7. Find the sum of the perimeters of all the shaded triangles that are added at each stage. Fill in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stage Number** | **Number of New Triangles** | **Length of Each Side** | **Perimeter of Each New Triangle** | **Total Perimeter of New Triangles** |
| 1 | 1 | ½ | 3/2 | 3/2 |
| 2 | 3 | ¼ | ¾ | 9/4 |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |

1. Predict the total perimeter of the new triangles that are added in stage 10.

