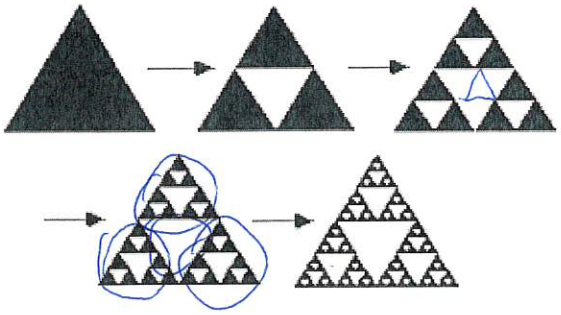
CCSS Algebra 3 A7: Exponents Name _____

1. Research **Sierpinski's Triangle**. Write a brief description of this fractal.

2. Use the first 5 steps of Sierpinski's fractal shown below to complete the table:



Stage	0	1	2	3	4	5
Number of Shaded Triangles	1	3	9	27	81	243
Fraction of Big Triangle Shaded	1/1	3/4	9/16	27/64	81/256	243/1024

3. Describe how the number of shaded triangles are growing in the pattern. Is this growth linear? Explain how you know.

Multiply by 3. Not linear because the slope changes

4. Describe how the fraction of the triangle that is shaded is changing in the pattern. Is the fraction of the triangle that is shaded increasing or decreasing? Is this change linear? Explain how you know.

Multiply by 3/4. It is exponentially decreasing. Not linear.

5. If you extended Sierpinski's Triangle to stage 10, how many shaded triangles would the triangle have? What fraction of the triangle would be shaded? Show your thinking.

$y = 1(3)^{10} = 59049$ triangles

$y = 1(3/4)^{10} = .056$ shaded

6. What if you extended Sierpinski's Triangle to stage 20? Stage 50?

$y = 1(3)^{20} = 3486\,784401$ $\quad$ $y = 1(3/4)^{20} = .00317$

$y = 1(3)^{50} = 7.18 \times 10^{23}$ $\quad$ $y = 1(3/4)^{50} = .000000566$

7. Can you determine a general rule for determining the number of shaded triangles at any stage (in other words, stage x)? Can you determine a general rule for determining the fraction of the triangle that is shaded at any stage? If you kept going forever, how many shaded triangles would you end up with in Sierpinski's Triangle? What fraction of the triangle would be shaded?

$y = 1(3)^x \longrightarrow \infty$ triangles

$y = 1(3/4)^x \longrightarrow 0\%$ shaded

8. Use your function to determine when Sierpinski's Triangle will have 177147 shaded triangles. What fraction of the triangle will be shaded?

$y = 1(3)^x = 177147$

$\log_3 \quad \log_3$

$x = \log_3 177147$

$x = 11 \longrightarrow y = 1(3/4)^{11}$

$y = .0422 \rightarrow 4.2\%$ shaded

9. What if you wanted to count the number of shaded triangles in 3 Sierpinski's fractals? How does this affect the general rule you found in question 6? Can you simplify the new rules?

3 fractals $\longrightarrow y = 3(3)^x$ & $y = 3(3/4)^x$

$y = 3^{x+1}$

10. Assume now that only 1 out of every 3 triangles are shaded at each stage of Sierpinski's fractal. How does this affect the general rules you found in question 6? Can you simplify the new rules?

Triangles

$y = 1$

Shaded

$y = 1(1/4)^x$