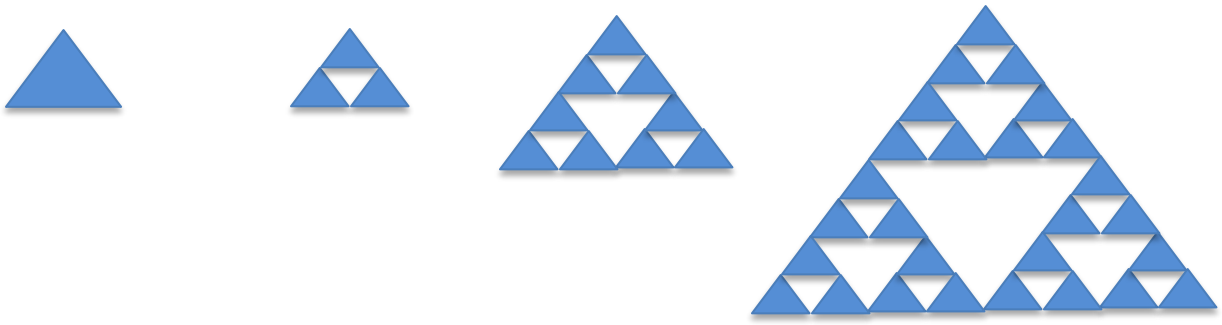
Sierpinski Triangles

A Sierpinski triangle is a fractal shape. Fractal math occurs in nature and you can spend hours exploring interesting patterns on the internet and trying to find them in nature. Fractals are never-ending repeating patterns. Of course, we don't have an infinite amount of time available to draw never-ending images so we'll show you how to draw a Stage 3 Sierpinski triangle.

Here's what we'll be constructing……

Stage 0 Triangle **Stage 1 Triangle** **Stage 2 Triangle** **Stage 3 Triangle**



Instructions for Drawing a Stage 3 Sierpinski Triangle

Step 1: Use the triangle template on the next page along with a ruler and a pencil

Step 2: Measure each side of the triangle and make a mark at the midpoint of each side (We've made a mark for the midpoint of the bottom side on the template).

Step 3: Once you've marked the midpoint of each side, use your ruler to draw a line connecting each midpoint. When you have completed this, you'll have the framework for the Stage 1 Triangle you see above (we won't be shading in the upright triangles until the end).

Step 4. Now, use your Stage 1 triangle to construct a Stage 2 triangle. For each upright triangle (point on the top and base on the bottom), repeat steps 2 and 3. This will give you a Stage 2 triangle.

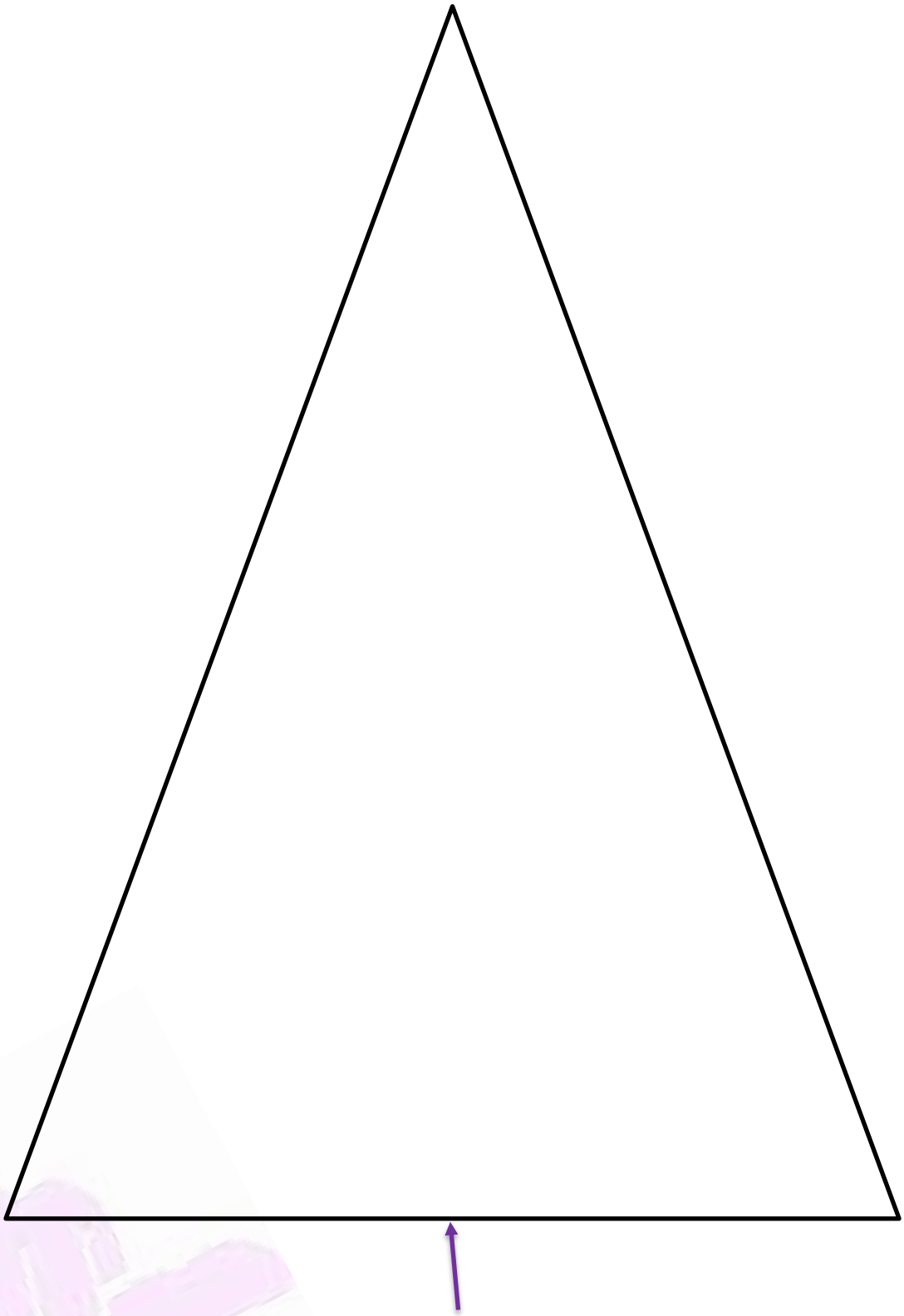
Step 5: Again, use your Stage 2 triangle to construct a Stage 3 triangle by repeating steps 2 and 3 for each upright triangle you have.

Step 6: Now that you have the framework for the Stage 3 triangle, you can color in the upright triangles to match what is shown above.

Note: The answer key shows the framework for all stages. This is one case where it's perfectly acceptable to look at the answer key while you're doing your work!

Sierpinski Triangles

Triangle Template



Sierpinski Triangles

CHALLENGE QUESTIONS

Test your knowledge of Sierpinski triangles by answering these challenge questions.

1. How many shaded triangles are in a Stage 0 Sierpinski triangle? Stage 1? Stage 2? Stage 3?

2. What about a Stage 4 Sierpinski triangle? How many shaded triangles would be in this stage?

3. What would be the general rule that predicts the number of shaded triangles for a given stage? For example, could you write the expression for the number of shaded triangles in a Stage 50 Sierpinski triangle?

4. At what stage do we have 243 shaded triangles?

5. What is the ratio of base length to altitude height for a Stage 0 triangle? What about the ratio of base length to altitude height for a shaded triangle in a Stage 1 Sierpinski figure?

6. Search for fractal shapes on the internet. What's your favorite shape?

7. Once you've practiced precisely drawing Sierpinski triangles, check out Vi Hart's video (https://www.youtube.com/watch?v=EdyociU35u8). You'll see how to draw other fractal patterns such as dragon curves and see how they can be related to Sierpinski triangle structures.

Sierpinski Triangles

CHALLENGE QUESTIONS

Test your knowledge of Sierpinski triangles by answering these challenge questions.

1. How many shaded triangles are in a Stage 0 Sierpinski triangle? Stage 1? Stage 2? Stage 3?
STAGE 0 = 1 TRIANGLE; STAGE 1 = 3 TRIANGLES; STAGE 2 = 9 TRIANGLES; STAGE 3 = 27 TRIANGLES

2. What about a Stage 4 Sierpinski triangle? How many shaded triangles would be in this stage?
STAGE 4 = 81 TRIANGLES

3. What would be the general rule that predicts the number of shaded triangles for a given stage? For example, could you write the expression for the number of shaded triangles in a Stage 50 Sierpinski triangle?

SHADED TRIANGLES FOR STAGE N = 3^N

4. At what stage do we have 243 shaded triangles?

$243 = 3^N \rightarrow$ N = 5 WE HAVE A STAGE 5 TRIANGLE

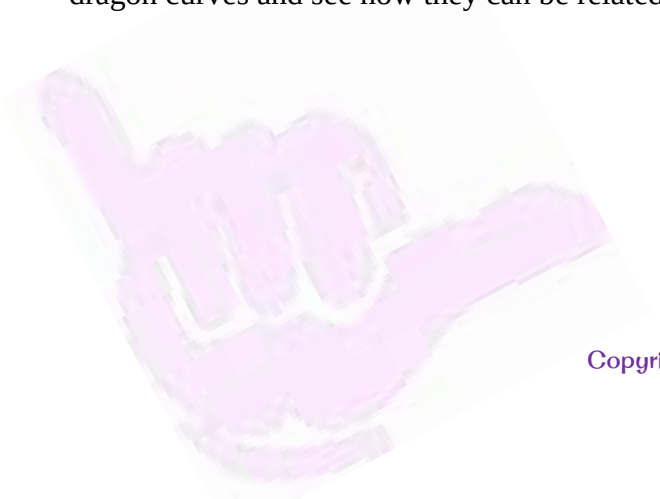
5. What is the ratio of base length to altitude height for a Stage 0 triangle? What about the ratio of base length to altitude height for a shaded triangle in a Stage 1 Sierpinski figure?

STAGE 0 BASE TO HEIGHT RATIO: 14 TO 19
STAGE 1 BASE TO HEIGHT RATIO FOR SHADED TRIANGLE: 14 TO 19

6. Search for fractal shapes on the internet. What's your favorite shape?

SOME OF OUR FAVORITE SHAPES ARE SIERPINSKI TRIANGLES, DRAGON CURVES, MANDELBROT SET AND MENGER SPONGE – MAYBE YOU'LL CREATE A NEW SHAPE THAT WILL BECOME ONE OF OUR NEW FAVORITES!

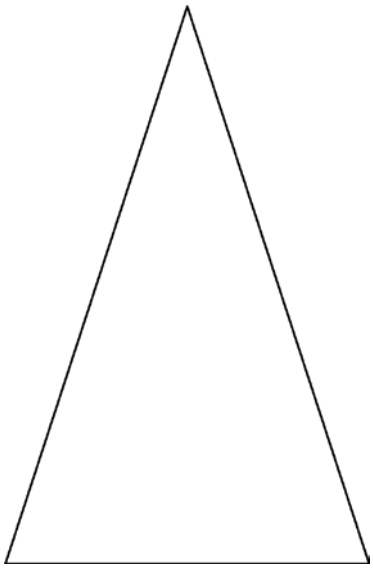
7. Once you've practiced precisely drawing Sierpinski triangles, check out Vi Hart's video (https://www.youtube.com/watch?v=EdyociU35u8). You'll see how to draw other fractal patterns such as dragon curves and see how they can be related to Sierpinski triangle structures.



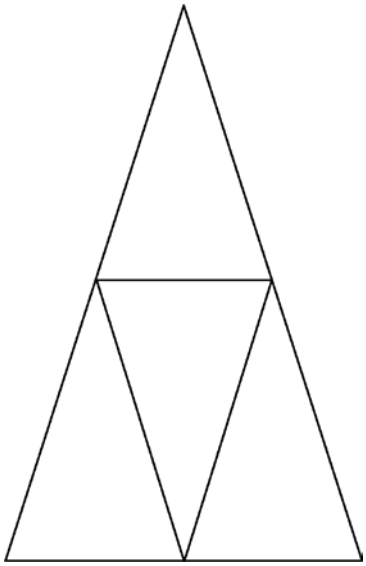
Sierpinski Triangles

SIERPINSKI TRIANGLE FRAMEWORKS

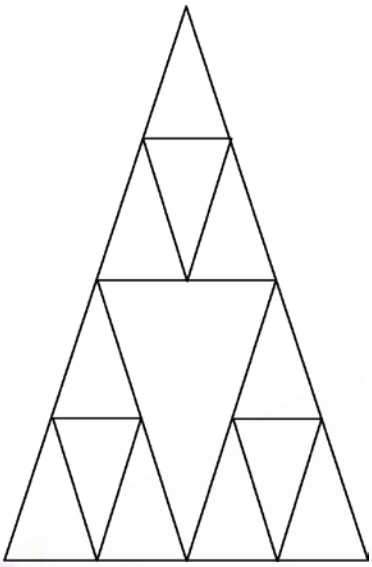
STAGE 0 TRIANGLE



STAGE 1 TRIANGLE



STAGE 2 TRIANGLE



STAGE 3 TRIANGLE