Investigating the Sierpinski Triangle

Objectives:

▲ Students will create a Sierpinski Triangle using Sketchpad.
▲ Students will identify the first four stages of the Sierpinski Triangle.
▲ Students will identify a pattern for the Sierpinski Triangle.

Directions:

Start Sketchpad. Click on File, click on New Sketch. In Sketchpad there is a toolbar with six tools on the left side. We will be using three of these tools:

- Selection Arrow Tool
- Point Tool
- Straightedge Tool

There is also a menu bar on the top. We will be using some of the options in that toolbar.

1. Create a triangle

▲ Click on the Straightedge tool.
▲ First create one segment. Left click on the mouse and move the mouse. (The length of the segment does not matter, we will adjust it later)
▲ Move the mouse to one of the endpoints, left click and create a new segment. Create one more segment between the two endpoints to create a triangle.

2. Select endpoint

▲ Click on the Selection Arrow tool.
▲ Click in the white space to deselect any points or segments.
▲ Click on any of the three points in your triangle. (The point will be highlighted when selected)
3. Reshape your triangle.

- You can now drag your point to shape your triangle by clicking on a point and moving the mouse. Make the triangle big so it fits the page.
- Click in the white space to deselect the point.
- Click on another point if you need to shape the triangle.
- Click in the white space to deselect the point.
- Click on the last point if you need to shape the triangle.
- The size of the sides or the angles does not need to be exact but try to make it look similar to an equilateral triangle. Something similar to this:

4. Label the points

- Click in the white space to deselect the points.
- Select the points. Start on the top and go counter clockwise. (The points will be highlighted when selected).
- Click on the Display option on the tool menu.
- Click on Label Points.
- When asked, click on A as the first label.

5. Create midpoints

- Click in the white space to deselect the endpoints.
- Click on each of the three sides to select them. (They will be highlighted when selected)
- Go to the Construct option on the toolbar.
- Click Midpoints

6. Label midpoints

- Click in the white space to deselect the midpoints.
- Click on the midpoints. Start at the bottom and go counter clockwise.
- Click on the Display option on the tool menu.
- Click on Label Points.
- When asked, click on D as first label.

7. Connect the midpoint

- Click on the Straightedge tool.
▲ Click on two midpoints to create a segment to connect the midpoints.
▲ Make to more segments to connecting all midpoints.

8. Construct interior

▲ Click on the Selection Arrow tool.
▲ Click in the white space to deselect the segments.
▲ Select the three midpoint (They will be highlighted when selected)
▲ Click on the Construction option in the toolbar.
▲ Click on Triangle interior.
▲ The inside triangle will be colored and highlighted.

9. Iterate

▲ Click in the white space to deselect the midpoints.
▲ Select points A, B, C. (Make sure they are highlighted)
▲ Click on the Transform option in the toolbar
▲ Click on Iterate
▲ When prompted, click on F such that A ⇒ F
▲ When prompted, click on B such that B ⇒ B
▲ When prompted, click on D such that C ⇒ D
▲ Click on the Structure box
▲ Click on Add new map
▲ When prompted, click on E such that A ⇒ E
▲ When prompted, click on D such that B ⇒ D
▲ When prompted, click on C such that C ⇒ C
▲ Click on the Structure box
▲ Click on Add new map
▲ When prompted, click on A such that A ⇒ A
▲ When prompted, click on F such that B ⇒ F
▲ When prompted, click on E such that C ⇒ E
▲ Click on Iterate
▲ You will now see your Sierpinski Triangle. This triangle is a Sierpinski Triangle at Stage 4

10. Print out your Sierpinski Triangle

▲ Click on the File option
▲ Click on Print Preview
▲ Click on Fit to page
▲ Click on Print
Investigation:

Look at these three different stages of the Sierpinski Triangle, and the one you printed out. Count the number of white triangles in each stage.

Stage 1  Stage 2  Stage 3

Fill out the attached table and see if you can discover the pattern.
Investigating the Sierpinski Triangle

Name_____________________________

Attach your Sierpinski Triangle level 4 and fill out the table. Can you find the pattern?

<table>
<thead>
<tr>
<th>Sierpinski Triangle Stage</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of White Triangles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of white triangles written with a exponent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$3'$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>