

Investigating the Sierpinski Triangle

Objectives:

- ▲ Students will create a Sierpinski Triangle using Sketchpad.
- ▲ Students will to 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

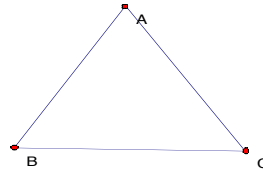
- ▲ Click on the **Straightedge** tool.
- ▲ First create one segment. Left click on the mouse and move the mouse. (The length of the segment does not matter, we will adjust it later)
- ▲ Move the mouse to one of the endpoints, left click and create a new segment. Create one more segment between the two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



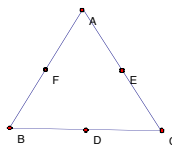
4. Label the points

- ▲ 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

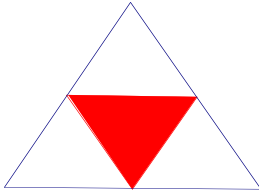
- ▲ Click in the white space to deselect the midpoints.
- ▲ Select points A, B, C. (Make sure they are highlighted)
- ▲ Click on the **Transform** option in the toolbar
- ▲ Click on **Iterate**
- ▲ When prompted, click on **F** such that $A \Rightarrow F$
- ▲ When prompted, click on **B** such that $B \Rightarrow B$
- ▲ When prompted, click on **D** such that $C \Rightarrow D$
- ▲ Click on the **Structure** box
- ▲ Click on **Add new map**
- ▲ When prompted, click on **E** such that $A \Rightarrow E$
- ▲ When prompted, click on **D** such that $B \Rightarrow D$
- ▲ When prompted, click on **C** such that $C \Rightarrow C$
- ▲ Click on the **Structure** box
- ▲ Click on **Add new map**
- ▲ When prompted, click on **A** such that $A \Rightarrow A$
- ▲ When prompted, click on **F** such that $B \Rightarrow F$
- ▲ When prompted, click on **E** such that $C \Rightarrow E$
- ▲ 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

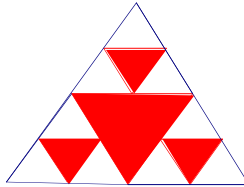
- ▲ Click on the **File** option
- ▲ Click on **Print Preview**
- ▲ Click on **Fit to page**
- ▲ Click on **Print**

Investigation:

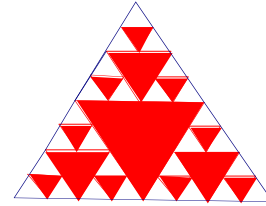
Look at these three different stages of the Sierpinski Triangle, and the one you printed out. Count the number of white triangles in each stage.



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?

Sierpinski Triangle Stage	1	2	3	4	n
Number of White Triangles	3				
Number of white triangles written with a exponent	3¹				