

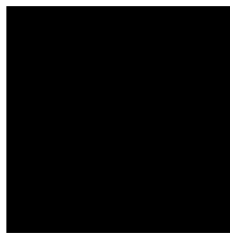
INTRODUCTION TO FRACTALS

Name: \_\_\_\_\_

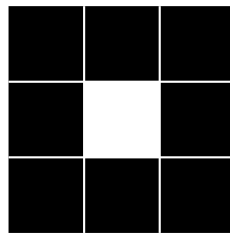
In-Class Activity

Fractal Geometry involves dynamic processes on shapes - very unlike the way you interact with shapes in a standard high school geometry class. One way to generate fractals is to begin with a standard geometrical shape and to make a change that you then replicate over and over at smaller and smaller scales. The initial shape is called an *initiator* and is considered to be *stage 0*. The change is represented in the next stage, **stage 1**, and is called the *generator*.

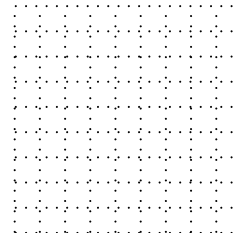
In order to understand and work well with fractals you need to develop a vision for what is being done at each stage and for how the sizes of the component shapes of each stage (perimeter and area) are related to the size of the figure in the stage 0, your initial figure. This involves a great deal of work with fractions and just having a sense of fractions.



stage 0  
initiator



stage 1  
generator



stage 2

In the image above you see the initiator and the generator. The initiator, the original large square, was cut twice on each side - making it actually a  $3 \times 3$  grid. Then the middle square of that grid was removed.

Q1: How many solid squares are there in stage 1? \_\_\_\_\_

Q2: In comparison to the original square, what size are the squares in stage 1? \_\_\_\_\_

Q3: Compared to the original, what length are the edges of the squares in stage 1? \_\_\_\_\_

TASK 1: Draw stage 2 by doing to each one of the squares in stage 1 what was done to the original square.

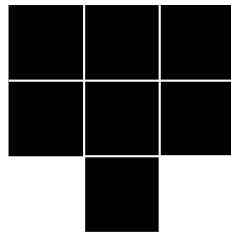
Q4: How many solid squares are there in stage 2? \_\_\_\_\_

Q5: In comparison to the original square, what size are the squares in stage 2? \_\_\_\_\_

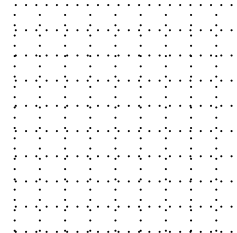
Q6: Compared to the original, what length are the edges of the squares in stage 2? \_\_\_\_\_



stage 0  
initiator



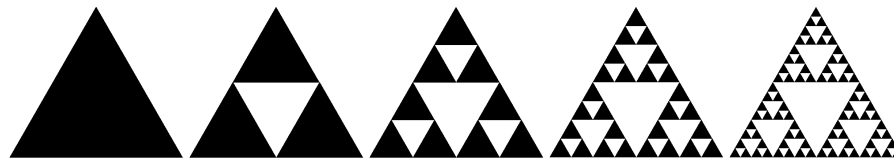
stage 1  
generator



stage 2

In the diagram above your task is to understand what took place between stage 0 and stage 1 and to repeat that process on all the squares remaining in stage 1 in order to get stage 2.

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Above you see stage 0 through stage 4 of the fractal known as the Sierpinski Gasket. Answer the following questions about this shape.

Q1: In comparison to the original triangle, what size are the triangles in stage 1? \_\_\_\_\_

Q2: Compared to the original, what length are the edges of the triangles in stage 1? \_\_\_\_\_

Q3: How many solid triangles are there in stage 3? \_\_\_\_\_

Q4: In comparison to the original triangle, what size are the triangles in stage 3? \_\_\_\_\_

Q5: Compared to the original, what length are the edges of the triangles in stage 3? \_\_\_\_\_

Q6: How many triangles are there in stage 4? \_\_\_\_\_

Q7: In comparison to the original triangle, what size the triangles in stage 4? \_\_\_\_\_

Q8: Compared to the original, what length are the edges of the triangles in stage 4? \_\_\_\_\_

Q9: What pattern do you see in terms of triangle size and edge size and in terms of number of triangles as you go from one stage to the next? Write out your findings, briefly, below: