

## SEQUENCES, FRACTALS AND ARTS.

### INTRODUCTION:

The aim of this project is to learn what a fractal is, to know two very famous ones and to investigate the relationships between geometry, sequences, limits and arts.

### OBJECTIVES:

- ✓ To work with the arithmetic and geometric sequences
- ✓ To review geometric concepts such as altitude of a triangle, perimeter and area.
- ✓ To calculate limits.
- ✓ To learn what a fractal is
- ✓ To use Geogebra for drawing Sierpinski triangle (or Sierpinski gasket).
- ✓ To use Geogebra for drawing Koch snowflake or Koch curve.
- ✓ To learn that there is a relationship between maths and Arts
- ✓ To write a report.

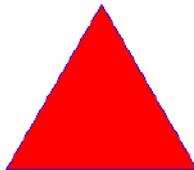
### 1.-TO START WITH .

- ✓ Watch this video <http://www.youtube.com/watch?v=XwWytTs06tU> .
- ✓ Find a understandable definition of fractal

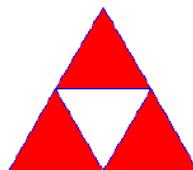
### 2.- WORKING WITH SIERPINSKI GASKET.

#### Explanation

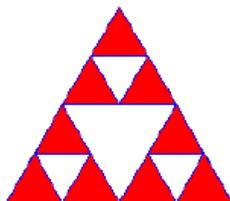
**Step 0** An equilateral triangle with side =a



**Step 1** Join the midpoints of each side, you'll obtain four triangles, give color to three of them as follows



**Steps 2,3,4,....**. Repeat step 1 in the colored triangles



## Exercises

Now complete the following tables and answer the questions

Table 1: NUMBER OF TRIANGLES	
Step	Number of colored triangles
1	1
2	3
3	
4	
n	

1. What kind of sequence is?
2. Write down its general term
3. Calculate its limit

Table 2: PERIMETER				
Step	Number of colored triangles	Side length	Perimeter(1 triangle)	Perimeter
1	1	a	3a	3a
2	3	a/2		
3				
4				
n				

4. What kind of sequence are columns 3, 4 and 5?
5. Write down their general terms
6. Calculate their limits

Table 3: AREA							
Step	Number of colored triangles	Side length	Height	Area (1 triangle)	Colored area	Blank area	
1	1	a	$\frac{\sqrt{3}a}{2}$	$\frac{\sqrt{3}}{4}a^2$	$\frac{\sqrt{3}}{4}a^2$	0	
2	3	a/2	$\frac{\sqrt{3}a}{4}$	$\frac{\sqrt{3}}{16}a^2$			
3							
4							
n							

7. What kind of sequence are columns 3, 4, 5, 6 and 7?
8. Write down their general terms
9. Calculate their limits
10. What can you say about the limit of the perimeter and the limit of the areas? which one is finite and which one is infinite?

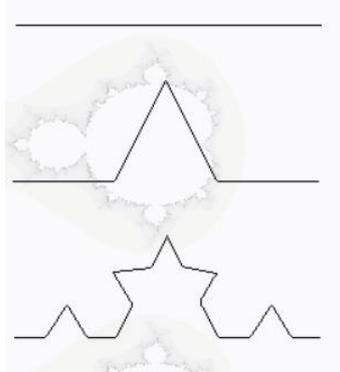
### Geogebra:

Use Geogebra to draw a Sierpinski gasket ( 4 steps)

### 3.-WORKING WITH KOCH SNOWFLAKE.

#### Explanation

Koch curve starts with a line segment in step 0, in step 1 the segment is divided in three equal parts and the part in the middle is substituted by two equal parts that form an angle of 60 degrees, in step 2 the process is repeated for each line segment.



#### Exercises

Now complete the following tables and answer the questions

Table 1:NUMBER OF LINE SEGMENTS	
Step	Number of line segments
0	1
1	4
2	16
4	
n	

1. What kind of sequence is?
2. Write down its general term
3. Calculate its limit

Step	Number of line segments	Length (1 line segment)	Length (curve)
0	1	a	a
1	4	a/3	4a/3
3			
4			

n
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4. What kind of sequence are columns 3, and 4?
5. Write down their general terms
6. Calculate their limits

## Geogebra

Make a picture of Koch snowflake starting with a line segment, a equilateral triangle and a hexagon

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## 4.- THE REPORT.

Write a report explaining carefully your work. The report must include:

- ✓ Cover (Make a beautiful one, you can take photos or make a picture)
  - Title.
  - Name of each member
  - Date
- ✓ Index
- ✓ Objectives.
  - The main objective of this project is to \_\_\_\_\_
  - Other objectives are \_\_\_\_\_ and \_\_\_\_\_
- ✓ Tables.
- ✓ Graphs (Screenshot of your Geogebra files).
- ✓ Resources
- ✓ Conclusion
- ✓ Personal opinion.
  - I like/dislike this project because \_\_\_\_\_
  - The easiest activity in the project is \_\_\_\_\_
  - The most difficult one is \_\_\_\_\_

KEYWORDS: geometric sequence, common ratio or ratio, limit, finite area, infinite perimeter, side length, instructions to draw a SierpinskiGasket and a Koch snowflake