Sequences and Series Art Project

Choose at least one of the following projects to complete. Each project consists of a drawing portion and a math portion.

Nested Squares	Fibonacci Spiral	Von Koch Snowflake	Sierpenski's Triangle	Student Choice

Drawing/Art – Follow the instructions for the project to create a visual representation of a sequence/series. The piece must be minimum of 8.5 x 11 inch in size (if 2-Dimensional). 3-D Artwork is permitted. Sketch out rough drafts to make sure you're on the right track. Once you are ready, take your time in creating a final product that incorporates color and creativity. While I do not expect all of you to be supreme artists, your product will be graded on accuracy and execution. Please create a product that you are proud of and will enjoy showing the class.

Mathematics – Answer the follow-up questions for your project. It may be helpful to read through the questions prior to starting your drawing and/or fill out the table as you go. You may work with others to check your answers, but you are all responsible for turning your math in with your project. Please print out or copy down the appropriate page from google classroom, and attach it to the back of your art part.

(Side note, the write up asks for certain calculations. Your picture/art work does not need to follow those measurements. However, your picture should match your write-up. So, if you choose to draw the Sierpenski's triangle, you must do the write-up for Sierpenski's).

You may also choose to explore patterns/sequences/series/fractals that are not listed in this packet. If you choose a different project, you will need to show adequate amount of math (e.g. a table and recursive formula(s) for a property of your drawing).
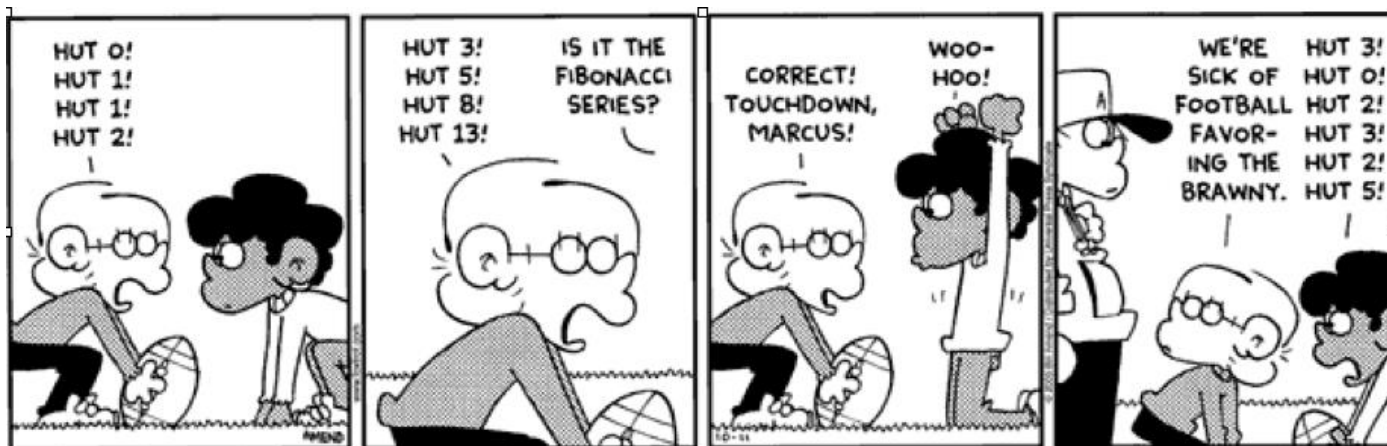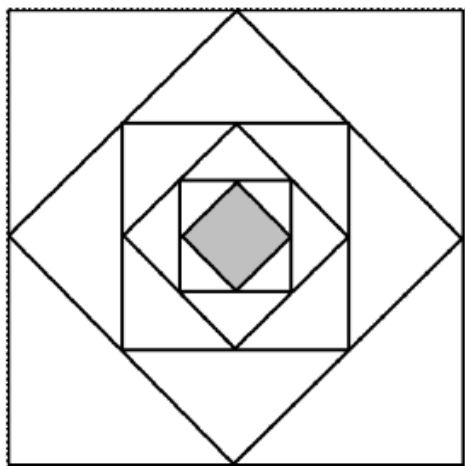

REVIEW THE RUBRIC TO MAKE SURE YOU HAVE MET THE REQUIREMENTS FOR THE PROJECT!!

Your completed project is due on Tuesday, September 17th and counts as a quiz grade.

Rubric

	Below Expectations	Meets Requirements	Above and Beyond!	Your Score:
Paperwork Stuff		Project is turned in with all parts completed ON TIME Student has name, period, and name of project listed on back of art work. Math write up is attached to project.		/10
Art	An attempt was made, however, It was sloppy or incomplete. Color was not used and/or project did not show precision in drawing. Student did not include a minimum of 5 levels of the sequence.	Art piece shows at least 5 levels of the sequence. Size of project is at least a full 8 ½ X 11 piece of paper (can be larger if desired). Some effort was made to color the project. Parts of the project may be messy or sloppy, but overall an effort was made.	Art piece shows at least 5 levels of the sequence. Size of project is at least a full 8 ½ X 11 piece of paper (can be larger if desired). Student has shown precision in drawing accurate sequences. Student used their creativity to make colorful and interesting. Effort is evident in artwork.	/40
Math	Write up is incomplete but attempted.	Write up is complete, but only partially correct.	Write up is complete and correct. If student has used their own sequence, they have included the recursive formula and table. They have explained why they chose their particular sequence.	/50
Total Points Earned:				

Nested Squares

Draw a square. Assume this square has a perimeter of 40 ft. Connect the midpoints of the square with straight lines; the new figure will also be a square. Continue this process and you will create a series of nested squares. Determine the lengths of the sides of the squares and perimeters of your squares.

1) Complete the table below. The first square you drew corresponds to n = 1, the second square is n = 2, etc. Hint: you will need to use the Pythagorean Theorem or special right triangles to find the length of the sides of the new squares.

n	1	2	3	4	5
Side Length of nth square (L_n)					
Side Length of nth square divided by 2 ($L_n/2$)					
Perimeter of nth square (P_n)					
nth partial sum of perimeters (S_n)					

2) Write a recursive formula for the perimeter of the nth square (P_n).

3) Write an explicit formula for the perimeter of the nth square (P_n).

4) Find the formula for the nth partial sum of the perimeters (S_n)

5) If the series for the perimeters of the square continues forever, what is the sum of the perimeters of all squares (S)?

6) Why is this sequence important?

Fibonacci Spiral

Draw two small squares. Each of these squares has a side length of 1.
Adjacent to the two squares, draw a third square that has a side
length of two (i.e. has the same length as the two small squares).
Continue rotating your paper and drawing squares whose sides
lengths follow the Fibonacci Sequence (1, 1, 2, 3, 5, 8, …). When you
run out of room, start the original squares and draw a spiral outward.
In each square you will be drawing a quarter circle; the circle's radius
should match the side length of the square.
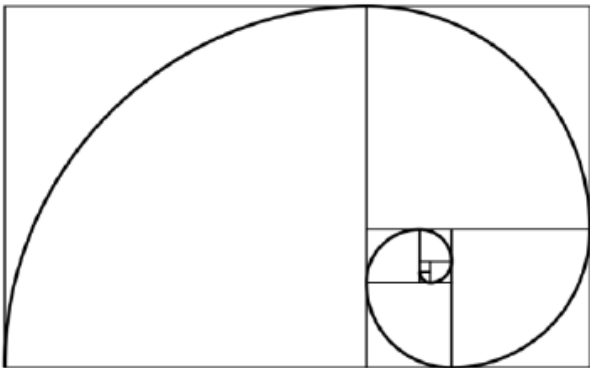
1) Write the recursive formula for the Fibonacci Sequence; you will
need to specify the first two terms (1 and 1).

2) Complete the following table, where f_n is the nth term of the Fibonacci Sequence.

n	1	2	3	4	5	6	7	8	9	10	11
f_n											
f_{n+1}											
f_{n+1}/f_n											

3) What value does f_{n+1}/f_n approach as n gets bigger? This value is the golden ratio.

4) Take the golden ratio and subtract 1. Find the reciprocal of the golden ratio. Notice anything?

5) Take the golden ratio and add 1. Square the golden ratio. Notice anything? Pretty cool, huh?

6) Draw a rectangle that has a short side that has a length of 1, and a long side with a length of the golden ratio. Do you find this rectangle visually appealing?

7) Why is this sequence important?

von Koch snowflake

Draw an equilateral triangle. Divide the sides of the triangle into thirds. Remove the middle third of each side. Add two additional line segments to each missing gap to form a smaller equilateral triangle. The first iteration of the snowflake should look like the Star of David. Continue this process until you cannot draw your triangles any smaller.

1) Complete the following table. Assume your first triangle had a perimeter of 9 inches.

n	1	2	3	4	5	6
Number of line segments (t_n)						
Length of each segment (L_n)						
Perimeter of snowflake (P_n)						

2) Write a recursive formula for the number of segments in the snowflake (t_n).

3) Write a recursive formula for the length of the segments (L_n).

4) Write a recursive formula for the perimeter of the snowflake (P_n).

5) Write the explicit formulas for t_n, L_n, and P_n.

6) What is the perimeter of the infinite von Koch Snowflake?

7) Why is this sequence important?

Sierpenski's triangle

Draw an equilateral triangle. Connect the midpoints of your sides with straight lines, which should form a smaller inverted equilateral triangle in the middle of the original triangle. The triangle you just drew is "removed" from the original. Now in the remaining three equilateral potions, remove another set of triangles by connecting the midpoints. Continue until your sections are too small to remove accurately.
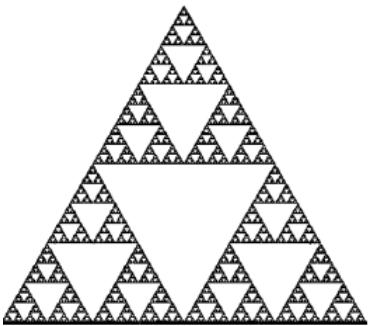
1) Complete the following table. Assume that your original triangle had an area of 100 cm^2 and that n =1 is the removal of the first triangle.

n	1	2	3	4	5	6
Number of triangles removed during iteration (t_n)						
Area of one of the removed triangles (A_n)						
Area removed during iteration (t_n x A_n)						
Total area remaining in Sierpenski's Triangle						
Total number of triangles removed (i.e. upside down triangles)						

2) Find a recursive formula for the area remaining in Sierpenski's Triangle.

3) What is the area of Sierpenski's Triangle after infinite iterations?

4) Find an explicit formula for the number of triangles removed (t_n).

5) Find a recursive formula for the number of upside down triangles in Sierpenski's Triangle after n iterations.

6) Why is this sequence important?