FMSP | Let maths take you further

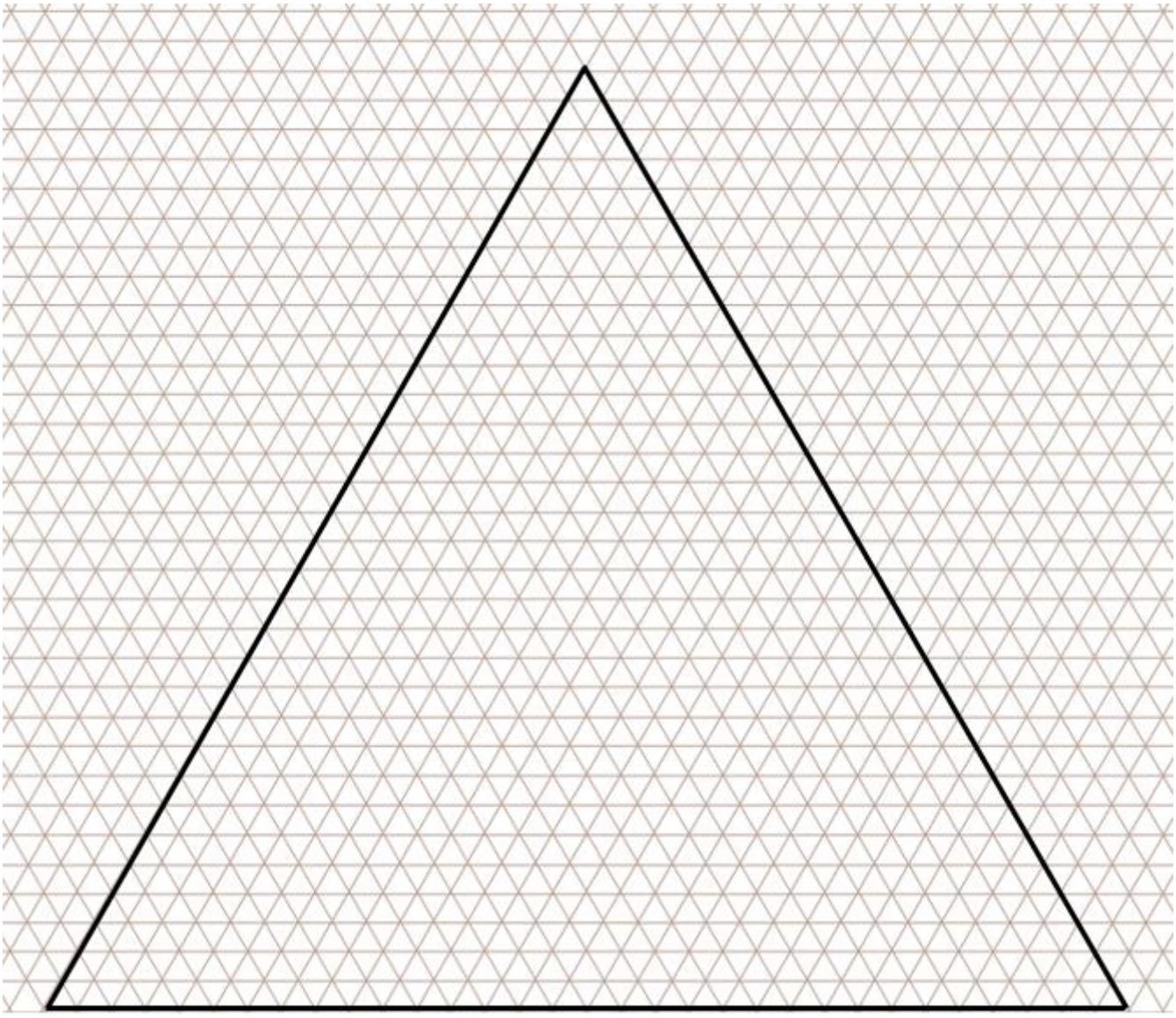
Fractals

Student Workbook

Name:_____

What is the definition of a Fractal?

The Sierpinski Triangle

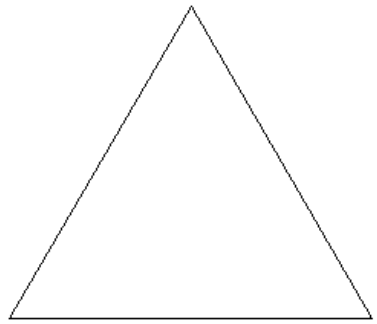


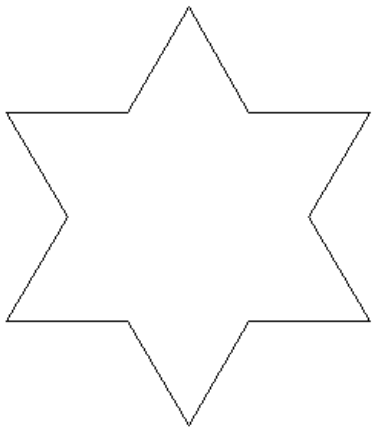
- Look at the triangle after the first iteration. What fraction of the triangle did you NOT shade?
- What fraction of the triangle is NOT shaded after the second iteration?
- What fraction of the triangle is NOT shaded after the third iteration?
- Do you see a pattern here? Use the pattern to predict the fraction of the triangle you would NOT shade in the fourth iteration.
- Can you confirm you prediction?
- What about the n^{th} iteration?

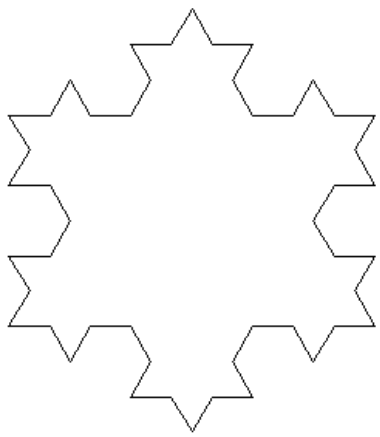
Iteration	Unshaded	Shaded
1		
2		
3		
4		
5		
n		

Snowflake

We have seen that the first few stages of the snowflake are given by:







Assuming that the length of each side of the triangle is 1 unit complete the following table:

STAGE	PERIMETER
1	3
2	
3	
4	
5	
6	

- Can you work out a formula for the perimeter at the n^{th} stage?

- Do you think the area of the snowflake curve is finite or infinite?

There be Dragons Here

1. Draw a straight line, say 2cm long, but the larger this line, the more stages you can draw. This is the start of your dragon.
2. Now draw two lines so that the original line forms the hypotenuse of an isosceles right-angled triangle and erase the original line. This is the first stage. (See the diagram below.)
3. For the second stage, replace each of the lines from the first stage with two new segments at right angles so that the lines from stage one form the hypotenuse of an isosceles right-angled triangle.
4. The new segments are placed to the left then to the right along the segments of the first stage.
5. Continue this construction, always alternating the new segments between left and right along the segments of the previous stage. This generates the `dragon curve'.

Can you draw the first few stages of the dragon curve?

Stage 1.

Stage 2.

Stage 3.

Stage 4.

How does this match the definition of a fractal?

Extension Activity: Pascal's Triangle.

Can you generate Pascal's Triangle to line 15?

Colour in the odd numbers.

What do you notice?