

**LessonTitle: Creating Fractals Using Transformations****Geo 6.5****Utah State Core Standard and Indicators** Geometry Content Standards Process Standards 1-4**Summary**

In this lesson, students examine the rotation and translation of right triangles used in creating different fractals by drawing in Microsoft word. They create an isosceles-right triangle, rotate and translate it to create a variation of the Sierpinski gasket triangle. The shrink the triangle and repeat the translation process to create the next fractal stage. This process continues to building an ever increasingly complex fractal. In the second part of the activity, students analyze different possible fractal patterns created by rotating the original triangle.

**Enduring Understanding**

Fractals are an endlessly repeating pattern of self similar figures. You can examine fractals using rotations and translations.

**Essential Questions**

- What are fractals?
- How can we use rotations and translations in the creation of a fractal?

**Skill Focus**

- Similarity concepts
- Rotations and translations

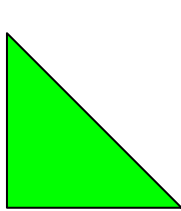
**Vocabulary Focus****Assessment****Materials****Launch****Explore****Summarize****Apply**

## Geo 6.5

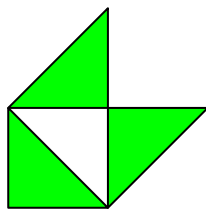
# Creating Fractals Using Reflection and Rotation

In Microsoft office, go to draw and turn on a grid. Then...

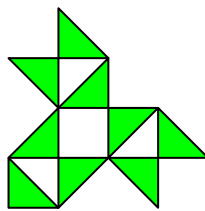
- Create the identity, stage 0. (see examples below)
- The building algorithm:
  - Step 1: Reduce the dimensions by half.
  - Step 2: Replicate and translate. Copy, paste and translate the identity twice. (slide, rotate, reflect--see examples below)
  - Step 3: Rebuild. Select the three triangles, go to draw and group them. Start again at Step 1.
- Repeat as many stages as desired



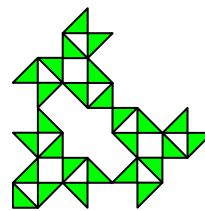
Stage 0



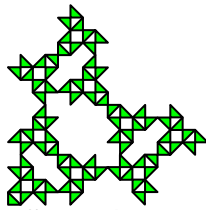
Stage 1



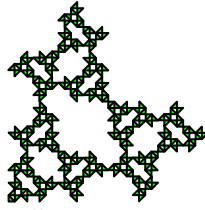
Stage 2



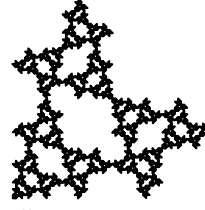
Stage 3



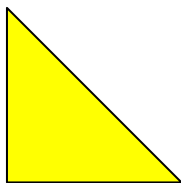
Stage 4



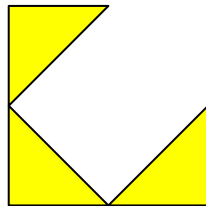
Stage 5



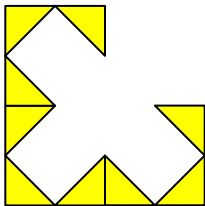
Stage 6



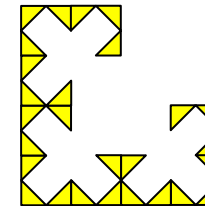
Stage 0



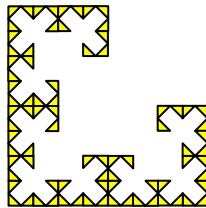
Stage 1



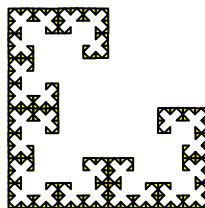
Stage 2



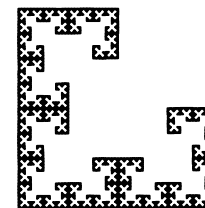
Stage 3



Stage 4



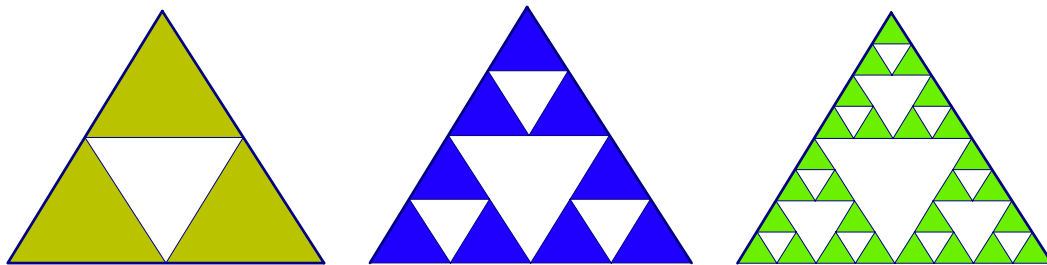
Stage 5



Stage 6

# Geo 6.5b

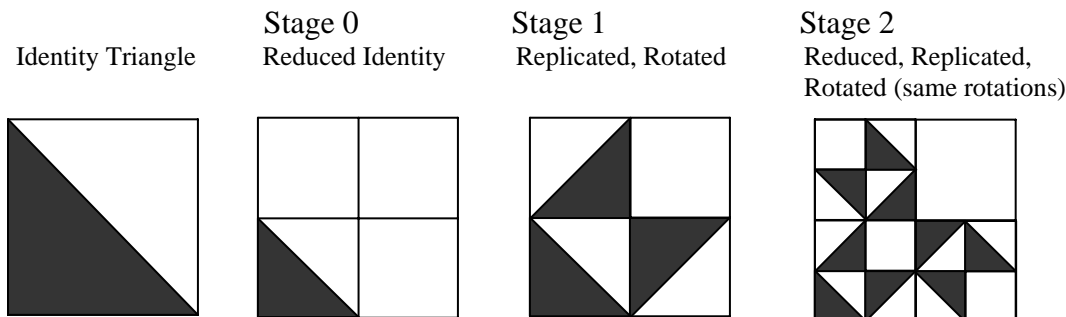
## Examining transformations in Fractals



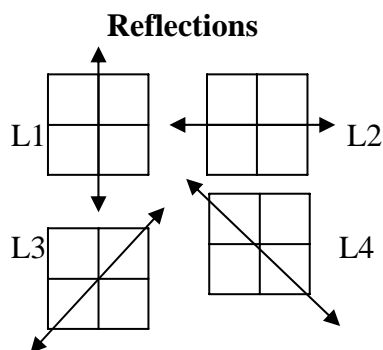
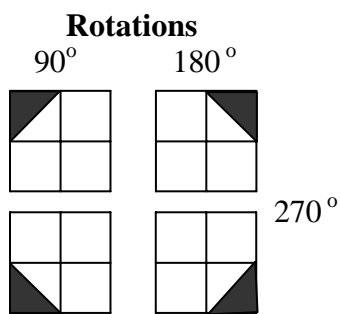
**Pictures above represent Stages 1 through 3 of the Sierpinski Gasket.**

Using a right triangle instead of equilateral (as shown below) we could create many variations of the Sierpinski triangle. (Please observe the reflection and rotation transformation examples.)

- Begin by rotating or reflecting the identity triangle in 3 locations of a square grid.
- Reduce and repeat this rotational process several times. Example:

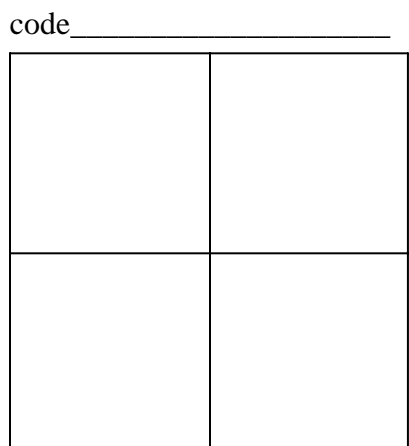
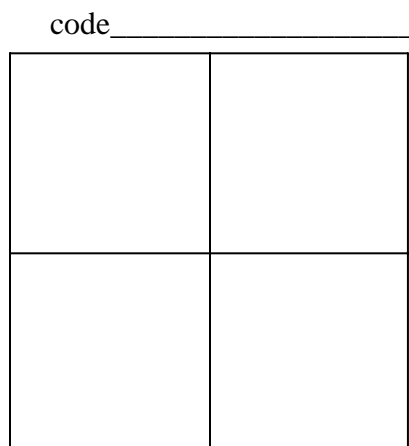
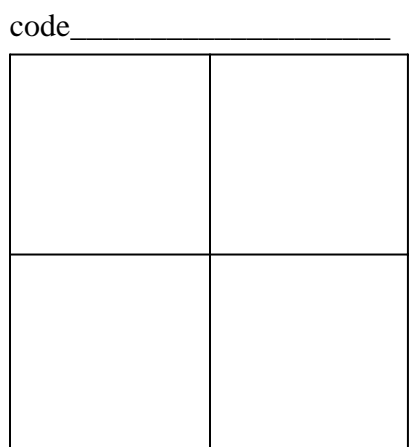
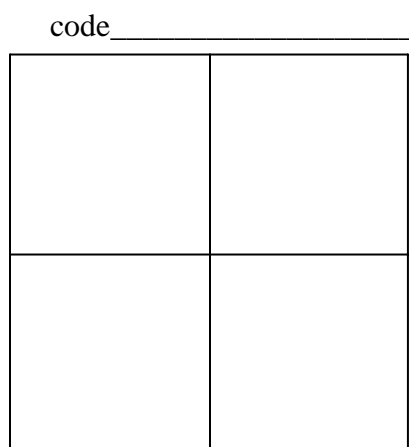
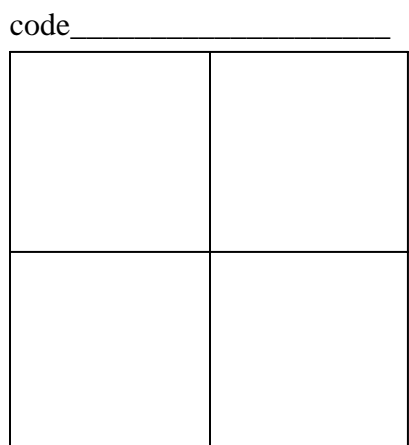
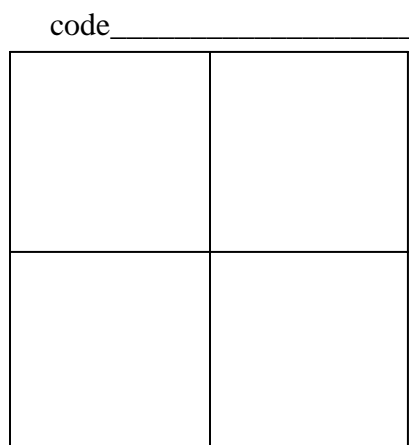


1) Which rotation and reflection transformations duplicate each other?



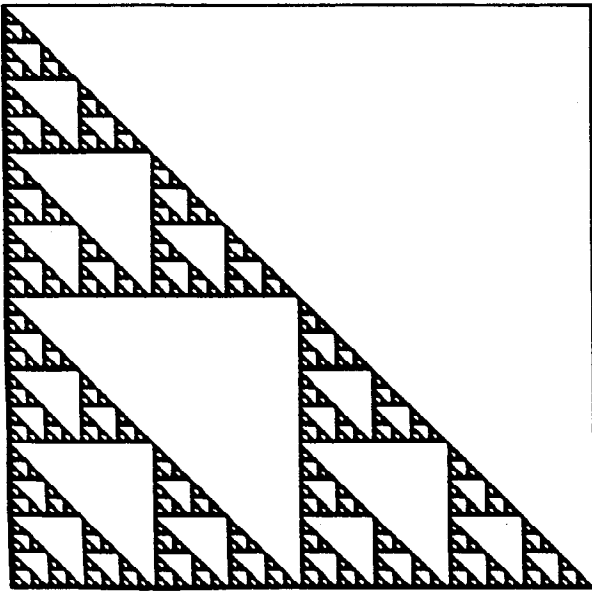
- How many different combinations of rotations or reflections are possible? How do you know?
- Rotate or reflect the identity to create 6 examples of stage 1 fractals.

b) Create a stage 5 (or more) fractal from one of your examples below. Use graph paper, cut out colored triangles or a computer drawing program.

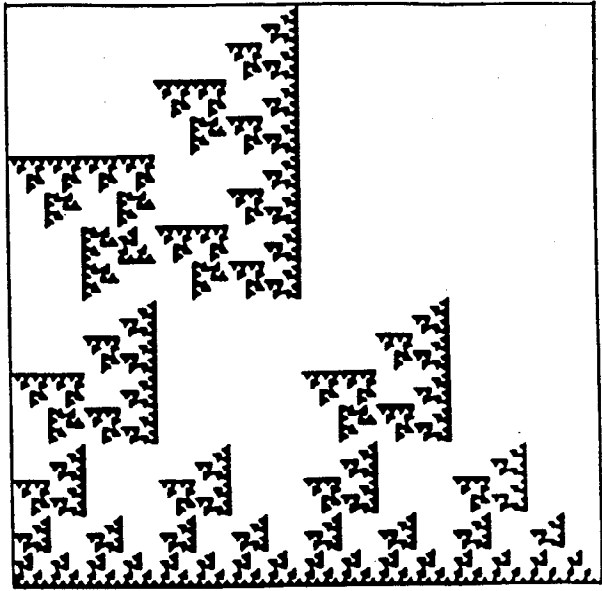


4) Identify the codes for the 4 rotation transformations below.

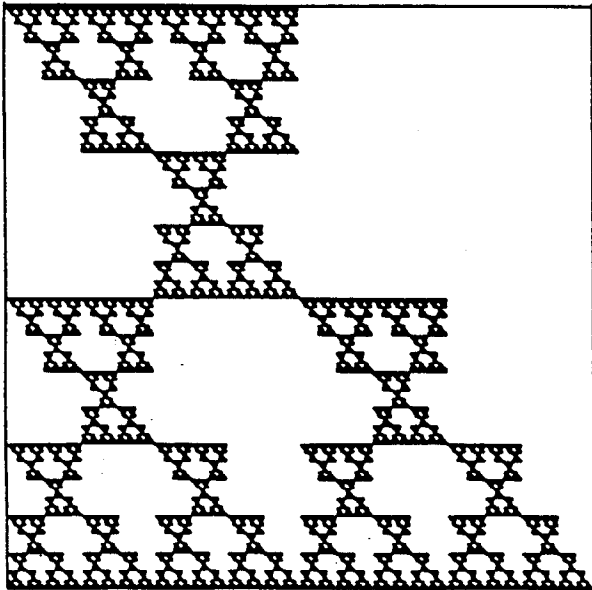
Code \_\_\_\_\_



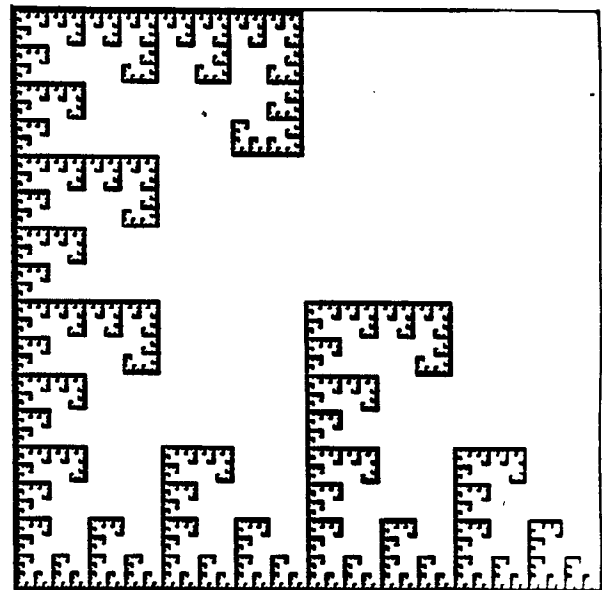
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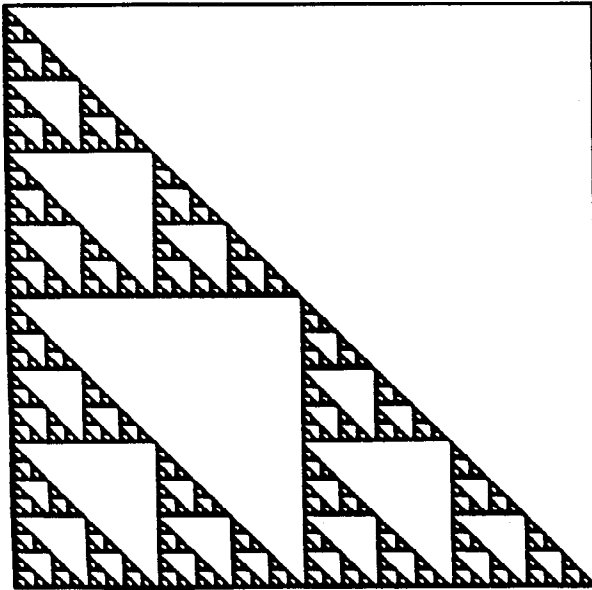


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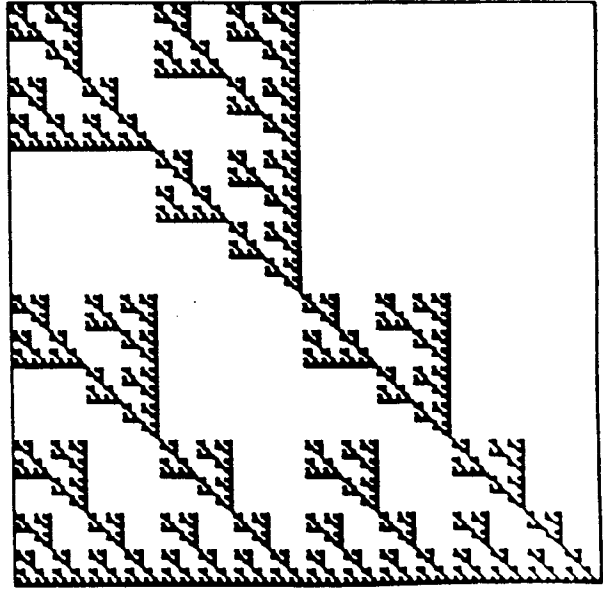


4) Identify the codes for the 4 reflection transformations below.

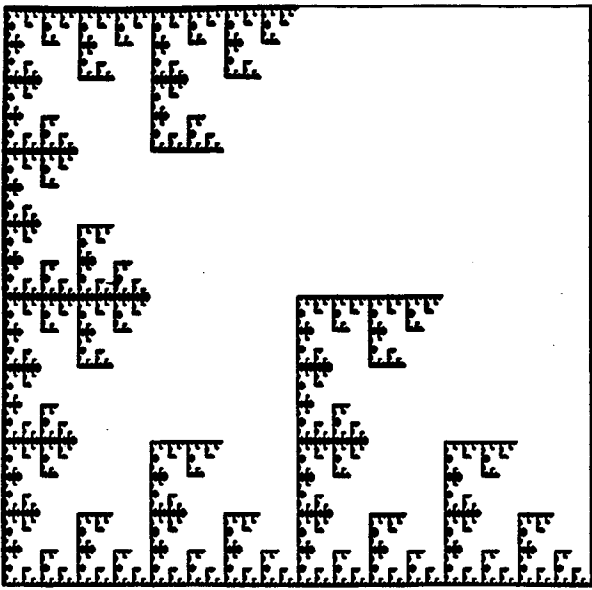
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