Koch Curve and Coastlines

1. Write one sentence that describes what a fractal is. Include some of the following: repeated or never ending pattern; something simple that, when repeated over and over gets complicated; pattern that gets bigger or smaller.

2. What are four types of fractal patterns that you learned about?
   a) **spiral**  
   b) **branching**  
   c) **geometric**  
   d) **algebraic**

3. What is a perimeter?  
   *The distance around a shape*

4. Using the worksheet on the following page, divide each line segment into thirds and replace the middle segment with the V shape like shown in the one example.

   Once you’ve done this for each line, in the table on the following page, report the number of line segments in total, the length of each segment and total length of lines.

5. Repeat this process two more times, making the lines smaller and smaller, continuing to fill in the table.

6. What trends do you see? Write a mathematical expression for the trends for number of segments, length of each segment and total length of lines.

   \[
   \text{# segments} = \times 4 \quad \text{length} = \div 3 \quad \text{total length} = + 1.3
   \]

7. Name three other things in nature that are formed by the same processes as in the Koch Curve.

   *snowflakes, mountains, coastlines*
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8. Using the following page, cut out the ruler, measure the perimeter of the outlined shape with the 2.5 cm length of ruler. Fill in the table for the number of counted units and calculate the perimeter.

9. Measure the perimeter of the shape with the 5 cm length of ruler and the 10 cm length, reporting the counted units and perimeter in the table.

10. Graph the perimeter for each of the ruler sizes. You have to determine the scale of the Y axis.

11. What pattern do you observe that relates the scale of the ruler to the resulting perimeter measurement?

less accurate

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The Koch Curve Fractal

Values in the table for Iteration 3 and 4:
- First copy of the "V". Fill in the entire time drawing the middle segment.
- Each time drawing the middle segment and replace it with a smaller copy of the "V". Fill in the entire time drawing the middle segment.
- Multiply the number of segments by the length of a single segment.
- Count how many segments you have now, and then multiply by the length of a single segment.
- You've found the total length of the Koch curve.

Using a pencil, divide each segment into 3 equal parts. Then replace the middle third of the segment with an upside-down "V", This is Iteration 2.

The first version of the shape, Iteration 1, has each 37 units long, for a total length of 108.
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<table>
<thead>
<tr>
<th></th>
<th>2.5 cm</th>
<th>5 cm</th>
<th>10 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counted units</td>
<td>23</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Perimeter</td>
<td>57.5</td>
<td>55</td>
<td>50</td>
</tr>
</tbody>
</table>

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