

The Coastal Paradox

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MAA Session on It's Circular:
Conjecturee Compute, Iterate
Joint Mathematics Meeting 2019
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CCU- Math Teachers' Circle

- Started in August 2016
- Middle School and High School Teachers
- Create accessible activities for our audience.
- Attended a session at Smokey Mountain MTC
- 3 Counties surrounding Myrtle Beach, SC
 - Tourist Beach town



Hula Hoop Island

- Challenged to measure the hula hoop
- Varying ruler length, collect data
- What happens as the ruler gets smaller and smaller?
- Findings: $2\pi r$
- **Conjecture: The smaller the ruler, the more precise the measurement.**





Coastline

- How could we measure the coastline?
- Come up with questions
 - What is coastline?
 - Smaller rulers are more precise.
 - How to physically do it? (too long)





Measure the SC Coastline





Measure the SC Coastline

- Created a model and tested our conjecture.
- Growing at a rate larger than 1.
- Challenged their earlier conjecture.
- ‘Infinite’ complexity
- What in the heck is the length of the coastline?





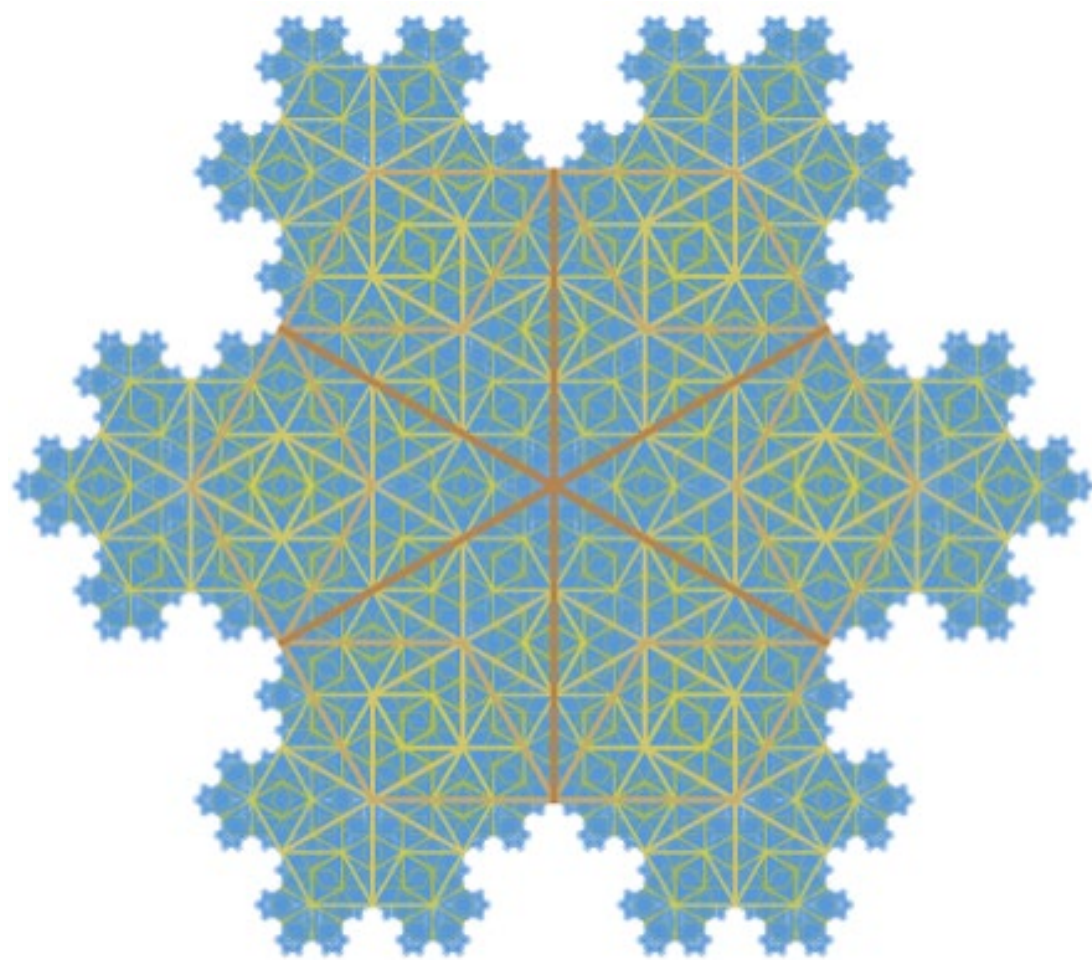
The Coastal Paradox

- A coastline's complexity changes with measurement scale. This results in a coastline behaving more like a fractal than a smooth curve.



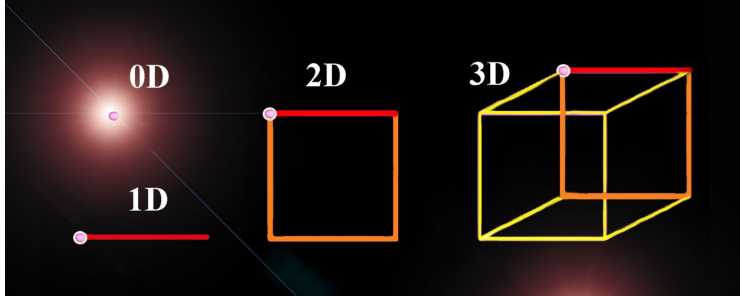
Koch Curve and Snowflake

- Collected more data
- Iterated :)
- Size, Scale, Number of pieces, and length
- Computed Area/Perimeter
- Compared characteristics of fractals to our coastline



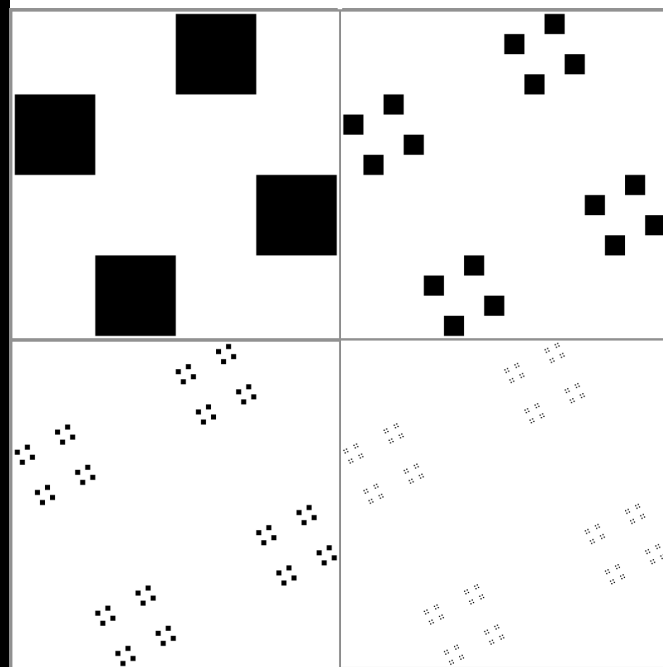
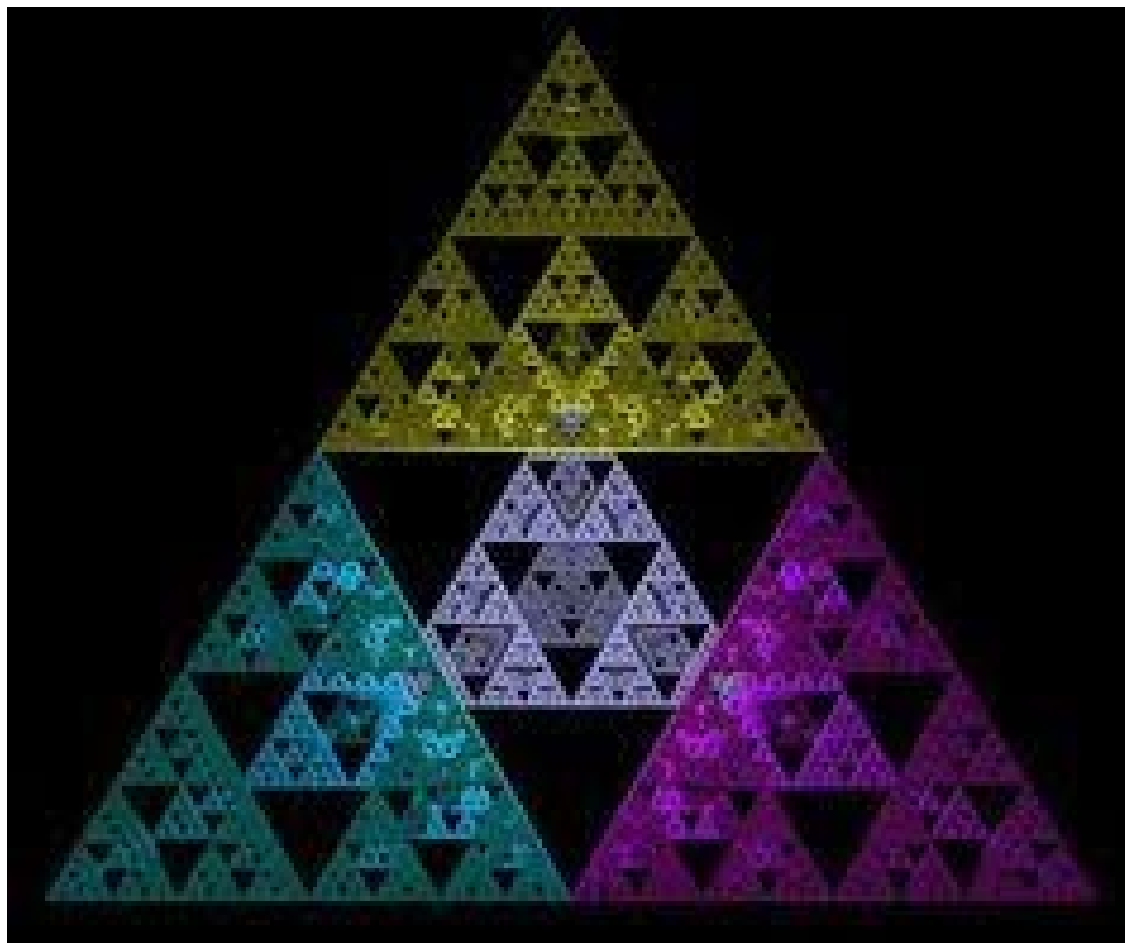


Extension: Fractal Dimensions



	<i>D=1</i>	<i>D=2</i>	<i>D=3</i>	<i>D=...</i>
$s = \frac{1}{1}$	1	1	1	. . .
$s = \frac{1}{2}$	2	4	8	. . .
$s = \frac{1}{3}$	3	9	27	. . .
.	.	.	.	$n = \frac{1}{s^D}$
.	.	.	.	
.	.	.	.	

Exploring Dimensions



Takeaways

- Context to explore size, scale, dimensions (Middle Level)
- Engaging students in math exploration with fractals (Frozen)
- Fun use of logarithms.
- Infinite sequences and series
- Fractals are fun!

Resources

- <https://sites.google.com/view/taracraig>
- Burger, Edward and Starbird, Michael. *The Heart of Mathematics: An Invitation to Effective Thinking*. 2013. Print.
- Measuring Coastline Numberphile
<https://www.youtube.com/watch?v=7dcDuVyzb8Y>
- Special thanks to Julie Barnes of Western Carolina University!

Questions?



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