Teaching briefs... Fractals in the Classroom

by Elyse Magram, with *quotes from an article in the school newspaper by Keith Knittel*

The classroom is a beehive of happy activity. Small groups sit clustered, eagerly measuring, talking quietly, contemplating the next generation of figures. The atmosphere is charged with the sounds of a video that shows a multitude of fractal colors and patterns. The computer program generating a fractal tree slowly adds branches to the varying trunk. Is this a scene from "Stand and Deliver"? No, a unit on fractals in one of my classes.

You know how excited she gets when she learns something new...she introduced virtually all of Smithtown West to the wonderful world of fractals.

I would like to share with you the enthusiasm generated in four of my high school classes as I introduced this multifaceted topic -- which I learned about mostly on my own. I found that fractals could be used equally with the slower learners in a 10th grade class and the brighter students in precalculus. Is it possible that through playing with fractals, the slow learners can achieve brightness? I now believe so.

We began the unit with a discussion of these self-similar figures and their applications in nature.

Fractals contain the property of self-similarity. In each fractal there are shrunken, repeated versions of the same shape. In nature, coast-lines, ferns, clouds, trees, lungs, intestines, and popcorn all have repeated fractal shapes. The coastline of Ireland has been matched to a computer generated fractal. In police work, crimes have been found to follow fractal patterns. Meteorologists have used fractals to chart the paths of tornadoes.

Then we proceeded to "make" fractals. Students loved doing "art" in math class, and to measure carefully and creatively. They found the Koch snowflake (see *Illustration* on page 4) particularly fascinating, and were intrigued with the lace-like effect of the fractal fern. The class worked cooperatively, sharing materials and ideas. The mathematics abounded, for we discussed a variety of topics, such as ratio of perimeters and areas, similarity, and the percent colored after each generation. In calculus classes, we discussed the limit of the perimeters and areas.

I highly recommend the topic as fascinating, colorful, a wonderful change of pace in a classroom, and one that will produce a magnificent outcome. Fractals get a high vote for one of the best math topics going.

Senior Nick Mequia says that "fractals are by far the most interesting things in the world" and is reported to have devoted his entire life to fractals.

Teaching briefs... Maps and Graphs

by Susan H. Picker

To extend the Konigsberg Bridge problem, and show students the applied nature of graph theory, it is very easy to construct maps with interesting Euler path/ciruit problems. I have found maps of cities with bridges such as New York, Paris, and Amsterdam to be particularly suitable, but any regional map can become the source of an imaginative problem requiring students to use their knowledge of the principles of graph and network theory. Below and on page 9 are two examples I have used with great success in both remedial and honors classes.

The map below depicts the bridges and tunnels connecting Manhatten with the other boroughs of New York City and with New Jersey. Is it possible to start at the Meadowlands in New Jersey, travel each bridge and tunnel exactly once and end at Shea Stadium in Queens? Is it possible to start at the Meadowlands and end at Yankee Stadium in the Bronx? Draw a graph and explain your answers.