The Return of the Sierpinski Gasket

        This pattern is named after Vaclav Sierpinski, a Polish mathematician who described it in 1915. To make it start with an equilateral triangle. You can use blank paper or triangle grid paper. Find the midpoint of each side. Connect the midpoints with straight lines. Now you have four smaller triangles. "Remove" the middle triangle by coloring it. Then *iterate!* That is, follow the same steps on the three smaller blank triangles. How many levels will you do?

1) Create a beautiful piece of mathematical art!

2) Make a table to keep track of your different levels. On the triangle grid paper, each side of the original triangle is 12 units long. Try to keep track of the triangles that have not been colored. (Older students, can you keep track of the area too?) Your table could begin like this:

Level	Number of Triangles	Perimeter
1	1	36
2	3	54

3) If we could make an infinite number of levels the Sierpinski Gasket would be a *fractal.* Can you find other examples of fractals?

4) Do you remember Pascal's Triangle? Make a Pascal Triangle and color in all the even numbers. What do you get?!

5) Is the total area of our remaining (uncolored) triangles going up or down? What about the total perimeter of our remaining triangles?

Have fun!

When Math Really Matters!

Preface:

      These problems are aimed at our older students. Younger students might enjoy the Sierpinski Gasket instead.

Introduction:

      Poor Richard! He's spent his whole life as a teacher, so he doesn't really *know* much about the real world. That's why he urges you to do #1. In #2 through #8 he has tried to make up examples of math in the world. And # 9 *is* a true story.

1) Talk to your parents or other family members and ask them how they use math in their work. Ask how math is important in work or in personal finance and budget questions. Ask if you can help with some real world math, such as planning a trip!

2) Football! In football a field goal scores 3 points for your team. A touchdown (usually) scores 7 points for your team. It's the last play of the game, and your team is losing 14 to 21. Should you kick a field goal or go for the touchdown? What if your team was losing 17 to 20? 10 to 14? Or 10 to 12? What should you do? Can you find other examples where math is important in football or other sports? (Thanks, Ez!)

3) On the road! You're on the interstate and the sign says "Service Area 1 Mile, Next Service Area 87 Miles." Your gas tank holds 12.5 gallons, and your fuel gauge is about at 1/4. Should you stop for gas here or wait for the next service area?

4) More company! You have a great recipe for potato salad (shown below). It's enough for 6 people. Suddenly you hear 18 people are coming over. What amounts should you use to make sure there's enough?

6 potatoes	3/4 cup chopped leek	1 1/2 cups scallions
1 1/4 tablespoon mustard	1/2 teaspoon salt	1/3 teaspoon pepper
2 1/4 tablespoons olive oil	1 3/4 tablespoons vinegar	

5) Wilderness medicine! You're the first-aid person on the trip and someone is very sick. Luckily you have the right medicine. The instructions say "Administer 12 mg per kg of body weight." Your patient weighs 130 lb. How much medicine should you give?

6) Remitting sales tax! Your store did very well in the last quarter--total receipts (including tax) of $84,275.50. You remembered to collect 8% sales tax with each sale. Now you have to send the sales tax to the state. How much should you send?

7) Lost at sea! In June you were sailing off the coast of New Jersey when a monster storm struck. You fought to keep your boat afloat, but at one point you slipped, hit your

head, and were knocked unconscious. Days later you wake up! Your mast is broken off, but your boat is afloat, and you seem to have no severe injuries. As the sun rises, you can see nothing but empty ocean. Your trusty digital watch says it is June 21. Your GPS is smashed to pieces; your radio is broken, but perhaps you can repair it. You have some water and crackers, and then you work on the radio all morning. The sun reaches its highest point in the sky, directly overhead, just as your watch says 11:00 AM. Now you've fixed your radio! What can you tell rescuers about your position?

8) Planning for retirement! Abner finished college at age twenty and started work. He asked his aunt and uncle for retirement planning advice. Aunt Bea said, "The key is starting early! Even if it's hard, invest $1000 a year starting right now. Do that till you're thirty-five. Then you'll have lots of family expenses and you can stop investing. You'll have a great nest egg by age sixty-five." Uncle Charlie said, "Oh, Bea, you got it all wrong! The kid's young and needs to have fun with his money now. He shouldn't start investing till he's thirty-five. Then he'll have a high paying job. He should invest $1000 a year starting at age thirty-five till he's sixty-five. The key is regular investing over a long period. With my plan he'll have a lot more!" Assume Abner can earn 8% on his investments. Whose plan will give him more savings by age sixty-five?

9) A true story! During April and May 1916, six men were sailing a tiny open boat-- only 22 feet long-- over the roughest seas on the planet. They had started their voyage at Elephant Island, off the coast of Antarctica, and they were hoping to reach South Georgia Island, 870 miles away! They were members of an Antarctic expedition whose ship had been crushed in the ice, and they were trying to rescue themselves and 22 companions left behind on Elephant Island. To succeed they needed courage, toughness, seamanship-- and *math!* The only way they could hope to hit their distant target and not go off course was with celestial navigation, and that required heavy duty math, all in the days before calculators. Here's a quote from *Endurance* by Alfred Lansing:

"The damage to Worsley's navigational books by the constant soaking was an even more serious problem. The destruction of these books could mean losing the way across this forsaken waste of ocean. And though every effort was make to protect them, they had to be taken out whenever a sight was taken.
Both covers of the logarithm book were soggy, and the wet was beginning to spread to the inside pages. The *Nautical Almanac*, with its tables of sun and star positions, was in even worse shape..."

Learn more about celestial navigation. Find out what logarithms are, and how people used logarithms to help in calculations before there were calculators. Find out more about this expedition. (The sailors triumphed and all lives were saved!)