

For April 1:

1. **Quiz 2:** You will be able to use your book, notes, and manipulatives. The quiz will be cumulative. Any suggestions of fair questions?
2. **Read Lockhart's Lament:** This is a 25 page article (it reads very fast) about mathematics education, and geometry in particular. The article can be found at http://www.maa.org/devlin/devlin_03_08.html. Click the link at the bottom of the page labeled Lockhart's Lament. We will discuss your thoughts on the article next week.
3. **Choose a nifty problem that you would like to study, ala Lockhart.**

Today we will think about a computational geometry problem: the Art Gallery Problem. Suppose you have an art gallery which you need to protect with security cameras that can each rotate to obtain a full field of vision. You would like to be able to use the minimum number of cameras necessary to view the entire gallery.

We will restrict ourselves to considering art galleries whose layout is given by a simple polygon. (What happens if you allow other shapes?) We will also restrict ourselves by only allowing security cameras to be placed vertices of the polygon. (What happens if you change this restriction?)

How many cameras will it take to guard your gallery? In particular, **what is the minimum number of cameras it will take to guard the gallery?**

Some questions to think about:

1. Draw the floor plan of a gallery with three vertices. What is the smallest number of cameras you need?
2. Create at least three interesting galleries and place cameras at as few vertices as possible. Sketch your floor plan.
3. Draw a floor plan of a museum with six sides that needs only one camera to view the entire gallery.
4. Draw a floor plan of a museum with 10 sides that needs exactly two cameras to view the entire gallery.
5. Write the number 6 as a sum of three natural numbers in several different ways, and, in each sum, circle a number that is less than or equal to 2.
6. If a natural number is written as the sum of three natural numbers, show that one of the numbers in the sum must be less than or equal to one-third of the original natural number.
7. Are there some specific simple polygons for which you can always do better than our general solution, i.e. you will *always* need less than the guaranteed minimum number of cameras?
8. What happens in three dimensions, i.e. if your museum is a simple polyhedron?
9. What would happen if the walls of your gallery were covered by mirrors, if your gallery had holes or obstructions, if your gallery had only right-angled corners, if your walls were curved...?