Chapel Hill Math Circle

Elementary Group

Oct. 15, 2016

Locker Problem

There are 100 lockers in a row on a long hall, all closed. A hundred students come by.

The first student opens every locker.

Then the second student closes lockers 2, 4, 6, 8, … etc. but leaves the other lockers alone.

Then the third student changes the state of lockers 3, 6, 9, 12, … etc. by opening the locker if it is closed and closing it if it is open.

The fourth student changes the state of lockers 4, 8, 12, 16, etc.

This pattern continues until finally the 100th student changes the state of locker 100 only.

How many lockers are open at the end?

Extra Problem

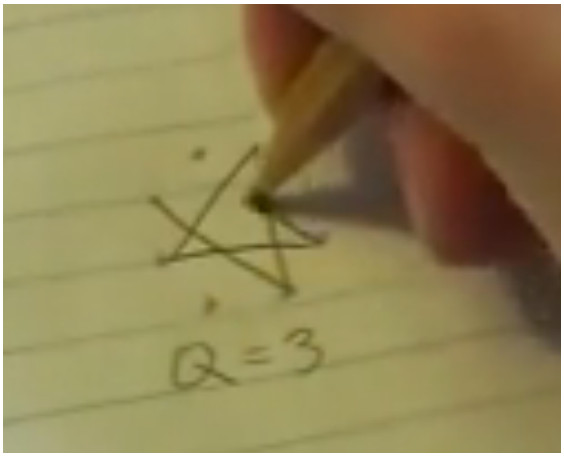
In the locker problem, what happens if student number 3 is sick and misses her turn? What if student number 3 goes twice? What if both students 3 and 9 are sick?

Drawing Stars

- Draw 5 points around a circle, evenly spaced. Start at a point, and going around the circle, connect it to a point 2 points over. Repeat. You should get a 5-pointed star.

- Now do the same thing, starting with 8 points around a circle, each time connecting to a point 2 points over. If you get back to your starting point before using up all the points, find a lonely point and start again.

- Experiment with different numbers of points around the circle "P" and different numbers of points that you go over "Q". Here is the beginning of a star where P = 8 and Q = 3.



- For what values of P and Q do you end up connecting all the points? For what values of P and Q do you end up getting back to your starting point before connecting all the points?

- What values of P and Q make the best looking stars?