Problems

Problem 1. How many regions can be created in a plane using N lines? How many regions can be created in a plane using N circles? How many regions can be created in 3-dimensional space using N planes? How many regions can be created in 3-dimensional space using N spheres?

Problem 2. Determine all values of N such that the sum $1^2 + 2^2 + \ldots + N^2$ is a perfect square.

Problem 3. Suppose point P lies inside equilateral triangle ABC and let the lengths $PA = x$, $PB = y$, and $PC = z$. Find the lengths of the sides of triangle ABC expressed in terms of x, y, and z.

Problem 4. Suppose point P lies inside square $ABCD$ such that angles $\angle PAB$ and $\angle PBA$ each measure 15 degrees. Find the measure of angle $\angle CPD$.

Problem 5. Determine the number of distinct paths from point $(0, 0)$ to point $(N, N+k)$, such that each path consists of moves to the east or north along lattice points (x, y) where $x \leq y \leq x + k$. [Hint: first consider particular small values of k.]

Problem 6. If points A, B, C, and D are chosen at random along a given circle, determine the probability that segment AB intersects segment CD. If points A, B, C, D, E, and F are chosen at random along a given circle, determine the probability that triangle ABC intersects triangle DEF.

Problem 7. How many total gifts are given in the song "The 12 Days of Christmas"? If additional verses are added in the same pattern, how many total gifts would be given in the song "The N Days of Christmas"?

Solutions, comments, and discussions should be sent to:

Ken Roblee
Department of Math & Physics
232 MSCX
Troy State University
Troy, AL 36082
(334)670-3406
FAX (334)670-3796
kroblee@troyst.edu

Vicky Eichelberg
Saint James School
6010 Vaughn Road
Montgomery, AL 36116
(334)277-8033
FAX (334)277-8059
eichelberg2@charter.net