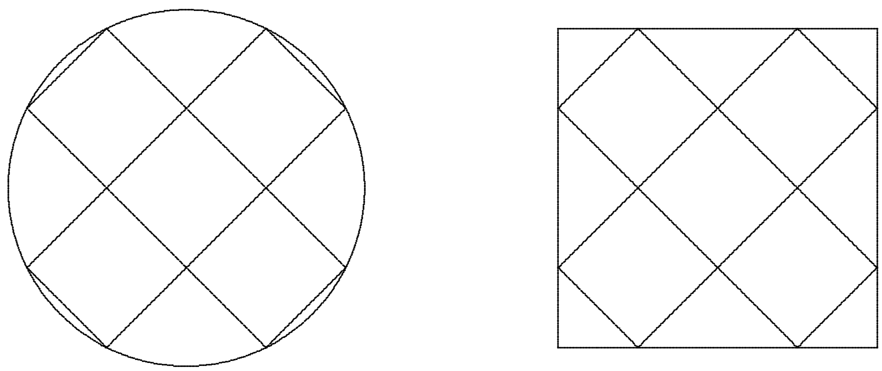
The Alberta High School Mathematics Competition
Part II, February 2, 2011.

Problem 1.
A cross-shaped figure is made up of five unit squares. Determine which has the larger area, the circle touching all eight outside corners of this figure, as shown in the diagram below on the left, or the square touching the same eight corners, as shown in the diagram below on the right.



Problem 2.
There is exactly one triple (x, y, z) of real numbers such that $x^2 + y^2 = 2z$ and $x + y + z = t$. Determine the value of t.

Problem 3.
On the side BC of triangle ABC are points P and Q such that P is closer to B than Q and $\angle PAQ = \frac{1}{2}\angle BAC$. X and Y are points on lines AB and AC, respectively, such that $\angle XPA = \angle APQ$ and $\angle YQA = \angle AQP$. Prove that $PQ = PX + QY$.

Problem 4.
Determine all the functions f from the set of integers to the set of positive integers such that $f(n-1) + f(n+1) \leq 2f(n)$ for all integers n.

Problem 5.
Seven teams gather and each pair of teams play one of three sports, such that no set of three teams all play the same sport among themselves. A triplet of teams is said to be *diverse* if all three sports are played among themselves. What is the maximum possible number of diverse triplets among the seven teams?