Name (Last, First): _____   Student ID: _____

Quiz 5 "Exploit Symmetry", February 12, 2015. You have 25 minutes to solve 2 of problems 1–3 below. Please write on both sides of the page. **Good Luck!**

Problem 1. Prove: You cannot colour the points of the plane with just three colours, so that no two points of distance 1 will be coloured with the same colour.

Problem 2 (Larson's 1.6.7). The faces of 15 pennies, packed as shown on the right, are each showing either "Q" (for "Elizabeth the Second, by the Grace of God of the United Kingdom, Canada and Her other Realms and Territories **Q**ueen, Head of the Commonwealth, Defender of the Faith"), or "M" (for the **M**aple leaf). Prove that there exist three pennies showing the same symbol and whose centres form the vertices of an equilateral triangle.
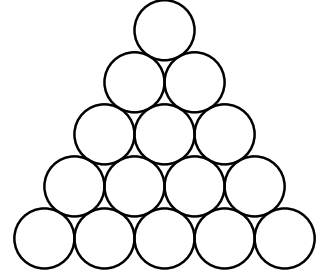
Bonus (2 points, even if you didn't solve the above). If the pennies pattern of the above problem was continued to cover the entire plane, which of the 17 tiling patterns would it be (ignoring the Q/M symbols)?

Problem 3 (Larson's 1.6.2e). Of all the n-gons which can be inscribed in a given circle, which has the greatest area?

Problem 4 (no credit, yet the best solutions will be advertised). What is your favourite "Exploit Symmetry" problem?