Problem Sheet 1

Planarity and graph minors

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Discrete Mathematics II, Winter 2013-2014
Deadline: 29th October 2013 (Tuesday) by 10:00, at the end of the lecture.

Problem 1: Prove that every 3-regular planar map with faces of length 5 or 6, has exactly 12 faces of length 5.

Problem 2: *Platonic solids*: a Platonic solid is a convex polyhedron where all vertices (resp. faces) have the same degree. Deduce that there exist just 5 Platonic solids. Which are the duality relations between them?

Problem 3:

1.- Draw K_6 in the real projective plane without crossings.

2.- Draw K_7 in the torus without crossings.

In both cases, it will be helpful to represent the surfaces using a polygon with glued borders.

Problem 4: Prove Wagner's Theorem (namely, that a graph is planar if and only if it does not contain K_5 or $K_{3,3}$ as a minor) from Kuratowski's Theorem.