DEPARTMENT OF MATHEMATICS

MATHS 190 Lecture 13 Summary

In this lecture, we investigated the regular (or Platonic) solids.

A **regular polygon** is a shape in the plane, with the sides being straight line pieces of equal length and with all the interior angles between sides being equal. We saw that there are infinitely many regular polygons.

Things are different in three-dimensional space, however. A **regular solid or polyhedra** is a three-dimensional object with all the surfaces being identical (flat) regular polygons and with the number of edges coming out of a vertex being the same for all vertices. It turns out that there are only five regular solids: the tetrahedron, cube, octahedron, dodecahedon and icosahedron. No other solids can be created with identical, regular polygonal faces meeting together so that the number of edges meeting at any vertex of the solid is the same.

We investigated the properties of the regular solids. We noticed that for any of the solids, the number of vertices minus the number of edges plus the number of faces is equal to two.

We also noted a duality between some of the solids. In particular, the cube and the octahedron are dual solids: by putting a vertex at the centre of each face of the cube and joining the vertices, we can create an octahedron (and vice versa). The dodecahedron and the icosahedron are also duals of each other. The tetrahedron is its own dual.

Before you come to the next lecture: You should spend an hour or two reviewing the material from today's lecture. You should also

- Read §4.5 in the textbook.
- Try some of the Mindscapes at the end of §4.5 in the textbook.

Other activities you could do if you have time are:

- Try to work out why there cannot be more than five regular solids.