GEM1518 Mathematics in Art and Architecture, 2003/04 II, Tutorial 4 Solutions

1. Why there are only five Platonic solids? Compare it with the proof that there are only three Platonic tilings of the plane.

Solution: Then interior angel of a regular n-gon is Π (n-2)/n. In a Platonic solid where d n-gons meet at each vertex, we have

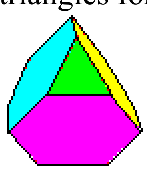
$d \Pi (n-2)/n < 2 \Pi$,
$(n-2)(d-2) < 4$.

The only possible solutions are:

n	d	Solid
3	3	Tetrahedron
3	4	Octahedron
3	5	Icosahedron
4	4	Cube
5	3	Dodecahedron

2. The cube and the octahedron are dual, and midpoint-truncation of either will give the cuboctahedron. In the same way, the dodecahedron and the icosahedron are dual, and midpoint-truncation of either will give the icosidodecahedron. What do you get if you do a midpoint-truncation of the tetrahedron?

Solution: Shrinking the hexagons in a truncated tetrahedron leaves us with eight triangles forming an octahedron.



[Helmer Aslaksen](#)
[Department of Mathematics](#)
[National University of Singapore](#)
[aslaksen@math.nus.edu.sg](#)
[www.math.nus.edu.sg/aslaksen/](#)