## Grade 6 Math Circles
Winter 2019 – March 5 & 6
Platonic Solids

Solutions

1. A solution to every problem on the website is beyond the scope of this document. Consult the website for answers.

2. Only the cube can tessellate 3D space as the angles do not work out for any other solid. To get a feel for this, you could make more platonic solids like we did in class and try fitting them together. You'll see that only the cube can tessellate 3 dimensions on its own. That said, the tetrahedron and octahedron can tessellate 3D space together.

3. The figure below demonstrates the arrangements of triangles, squares, and pentagons you should end up with. The interior angles of the polygons must add up to less than $360°$, otherwise the result is flat!
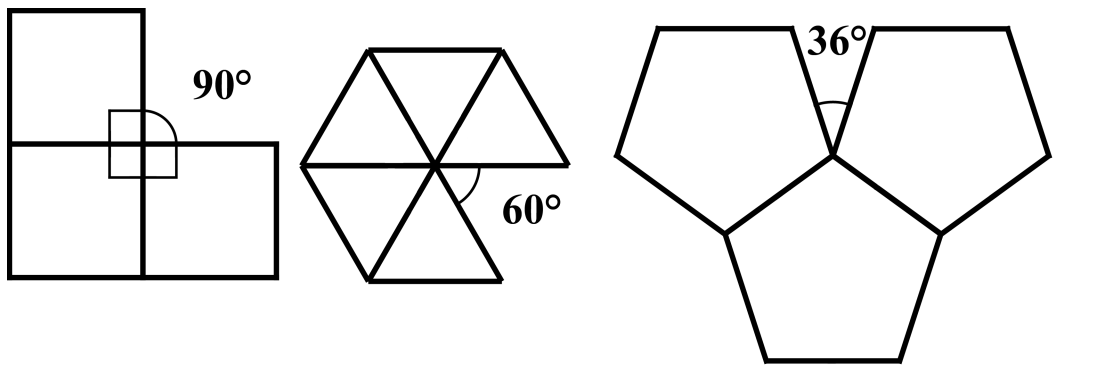
4. * The relationships between the number of respective vertices, cells, and number of spacial dimensions for each shape are as follows:

   (a) In n dimensions, the simplex has $n + 1$ cells and $n + 1$ veritces

   (b) In n dimensions, the cross-polytope has 2^n cells and $2n$ vertices

   (c) In n dimensions, the hypercube has $2n$ cells and 2^n vertices