Assignment #6

1. Read Chapter 3 of *Beyond the Third Dimension*. Again, make careful note of items and details that you don't understand yet.

2. Chapter 3 talks about slicing. Be prepared to discuss the following in class. Let's think about slicing a 3-dimensional polyhedron P with a plane. The result will be some sort of polygon Q sitting in three-dimensional space. Suppose you know the following facts:

   (a) The coordinates of the vertices of the polyhedron.

   (b) Which sequences of vertices form the boundaries of the various polygons.

   (c) The equation of the plane $ax + by + cz = d$.

   How could you figure out the coordinates of the vertices of Q and the sequence of vertices around the boundary of Q? Test your answer by trying the slice the cube having vertex coordinates $(\pm 1, \pm 1, \pm 1)$ with the plane $x + y + z = 0$.

3. Write up to turn in.

   (a) Assume P is a polygon with n sides and you use it as the base of a pyramid Q. How many vertices, edges, and 2-dimensional faces will Q have?

   (b) Assume P is a three-dimensional polyhedron with V vertices, E edges, and F 2-dimensional faces, and you use it as the base of a 4-dimensional pyramid Q. How many vertices, edges, 2-dimensional faces, and 3-dimensional faces will Q have?

   (c) Looking at the polyhedron P from the previous question, make the polynomial $V + Ex + Fx^2$. What happens when you multiply this polynomial by $(1 + x)$? What does this have to do with the numbers of faces of different dimensions of Q? Why? Illustrate your answer with a concrete example.

4. Play with Maple a little bit on your own (see the examples on the website). Practice making at least one polyhedron. You don't have to turn this in.