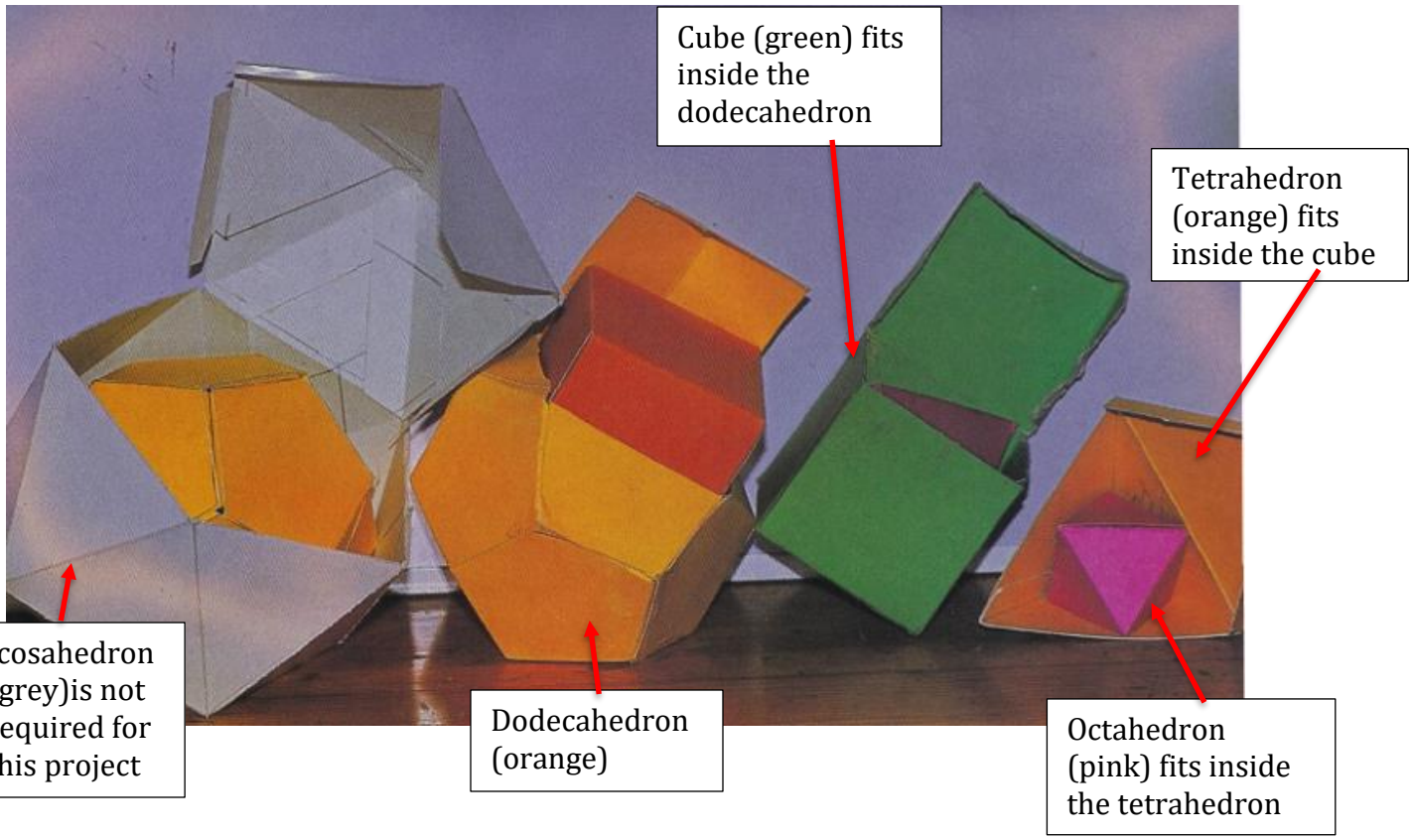
Nested Polyhedrons (20 points)

We will be creating nested polyhedrons in class to prepare for the Polyhedra project you will be doing on your own. We will start with a hexahedron (a cube), then "nest" inside it a tetrahedron, and nested inside that will be an octahedron. The final shape we will make is the dodecahedron, which fits around the cube.

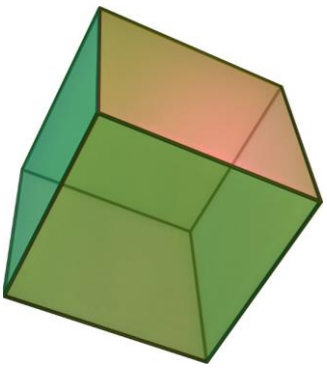


To create the nested set you will need to know what each shape looks like if it is drawn on a flat piece of paper. This layout is called the "net".

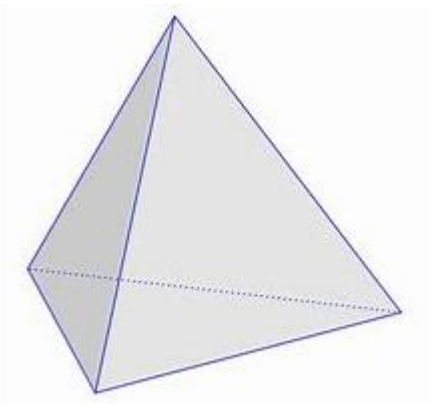
You will also need very accurate measurements. This will make is so that the net will fold up properly to create the correct 3-dimensional shape.

Use the guidelines given on the following pages. You will start by creating the cube.

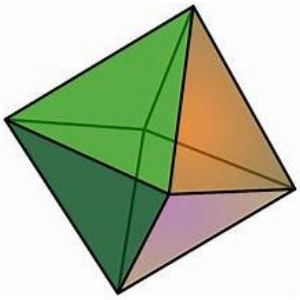
Cube



Tetrahedron



Octahedron



DO NOT CONSTRUCT YOUR SHAPES UNTIL YOU HAVE READ ALL THE DIRECTIONS!

I will only provide 3 pieces of cardstock so if you make mistakes you will need to provide your own materials.

Cube: Each side length should be **exactly 5 cm**. Be sure to make accurate 90° angles and accurately measure dimensions.

- What will the net look like if the cube is unfolded so that it can be drawn on a flat piece of paper?
- Where will you need tabs so that when you fold it up you can glue it together?

After you draw an accurate net on a piece of cardstock, cut it out and glue it into a cube.

Don't glue the top so that you will be able to "nest" the other polyhedrons inside it. The top will be like a lid that opens to allow the tetrahedron to be place inside.

Tetrahedron: The tetrahedron fits just inside the cube. A tetrahedron is made from 4 equilateral triangles.

You need to calculate the edge length of each equilateral triangle. This edge length is equal to the length of the diagonal of one side of the cube.

Once you calculate the length of the diagonal of your cube, be sure to round the answer down ~1mm. This allows the tetrahedron to actually fit inside your cube after construction.

- What will the net look like if the tetrahedron is unfolded so that it can be drawn on a flat piece of paper?
- Where will you need tabs so that when you fold it up you can glue it together?

Remember, don't glue down the lid. You will put the octahedron inside the tetrahedron.

Octahedron: The octahedron fits inside the tetrahedron. It is made of 8 equilateral triangles. The edge length of the octahedron is one half of the edge length of the tetrahedron.

Again, round the answer down ~1mm so that it will definitely fit inside. This one can be glued completely closed because it is the smallest shape.

The cube, tetrahedron and dodecahedron will all need a lid so that the other shapes can nest inside them. You may totally glue the octahedron shut.

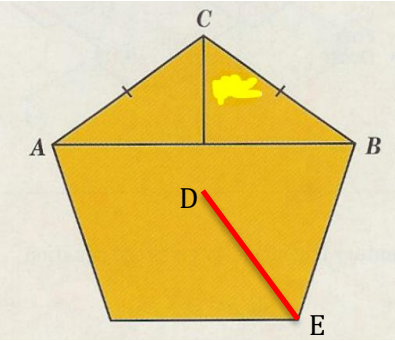
Dodecahedron

Create the dodecahedron that fits around the outside of the cube. When you complete this, you should have the dodecahedron with the cube inside, which has the tetrahedron inside, which has the octahedron inside.

All calculations for the edge length of the dodecahedron must be shown. A sample layout is provided. You must accurately construct the angles and assemble it so that the cube fits nicely inside.

Remember to cut a lid to insert the cube. This time, it is a good idea to round your measurement up ~1mm so that the cube will fit.

Length AB shown in the pentagon below needs to be the same as the edge length of your cube (5 cm). You must use this to calculate the edge length of the pentagon AC. In order to construct the pentagon, you will also want to calculate the length from the center of the pentagon to a vertex (length DE).



Sample net of dodecahedron

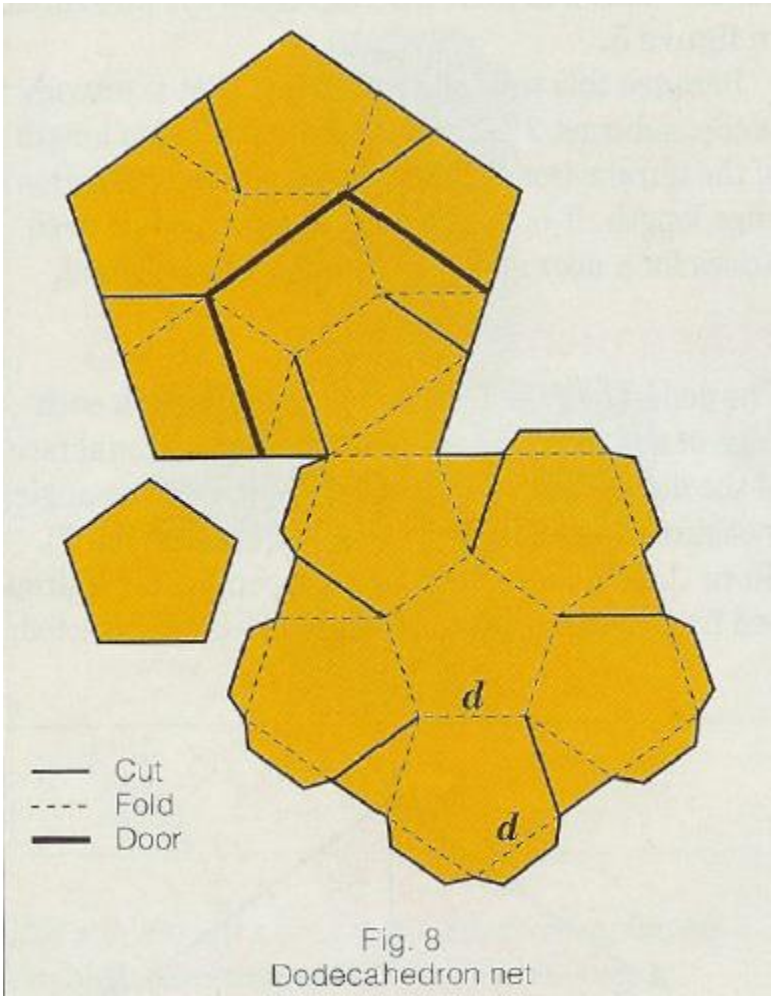


Fig. 8
Dodecahedron net