

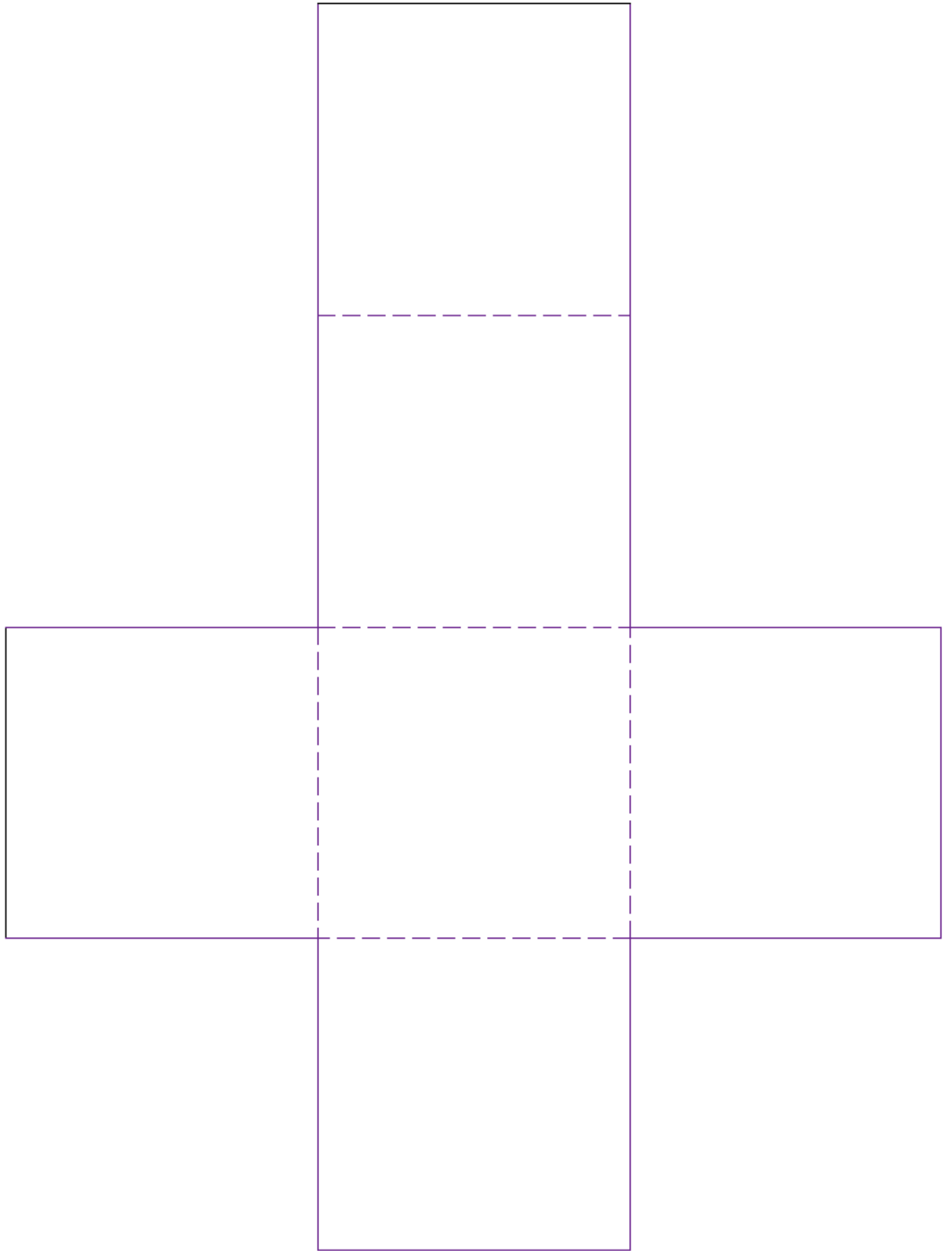
Models of solid bodies

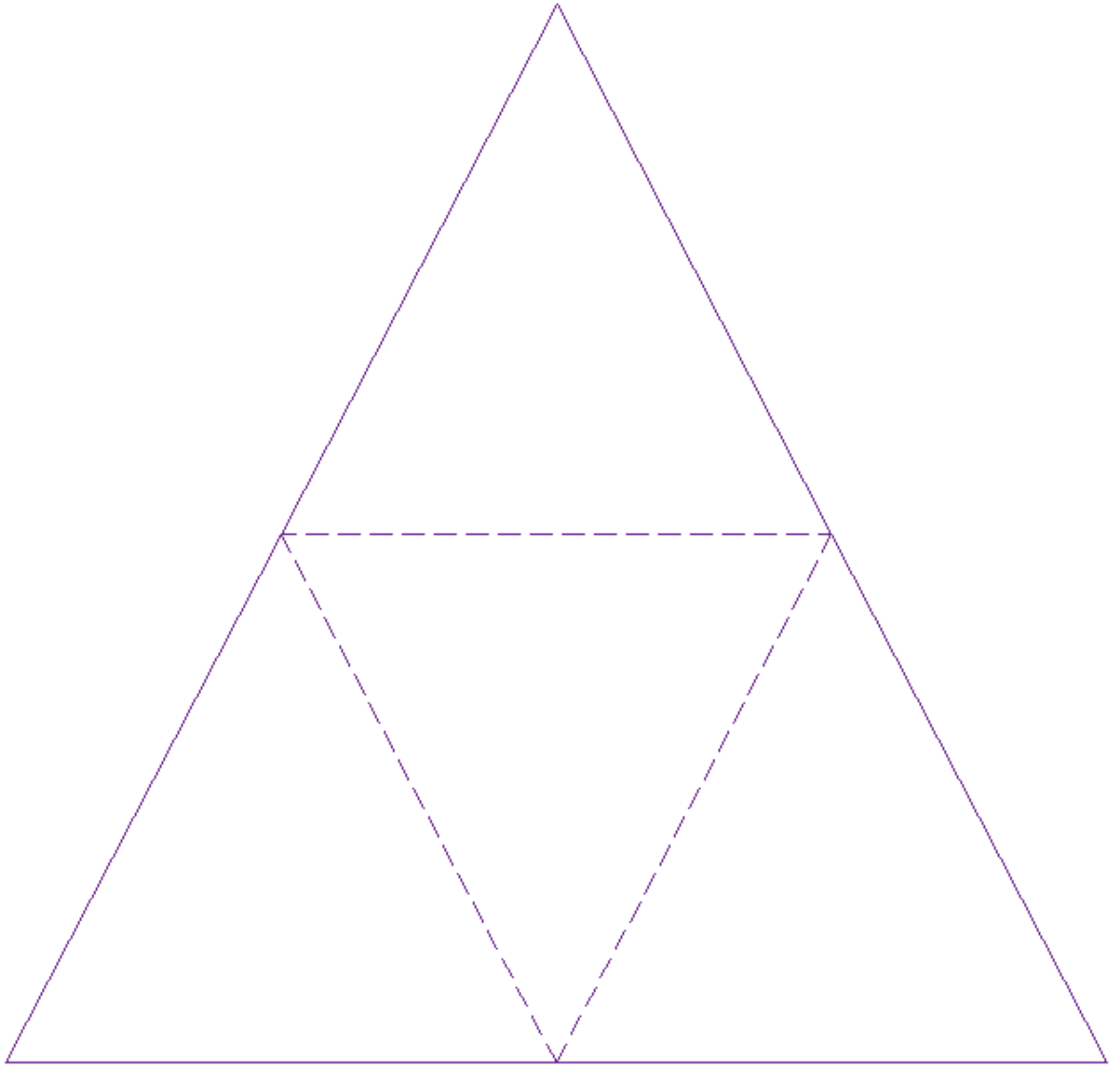
November 13, 2009

1. **Cube:**

The first net can be used to make a cube.

- (a) Before gluing a cube out of it, mark the opposite faces with identical pictures. (E.g, you can draw a circle on the “bottom” and the “top” faces, draw a happy face on the “front” and “back” faces, draw a star on the “left” and “right” faces).
- (b) After that, glue the cube. Check that the marks were put correctly. That is, check that opposite faces are marked with the same mark.
- (c) Make a model of the cube using clay/playdough and toothpicks. First decide how many toothpicks you will need for the edges and how many small balls of clay you will need for the vertices (corners).





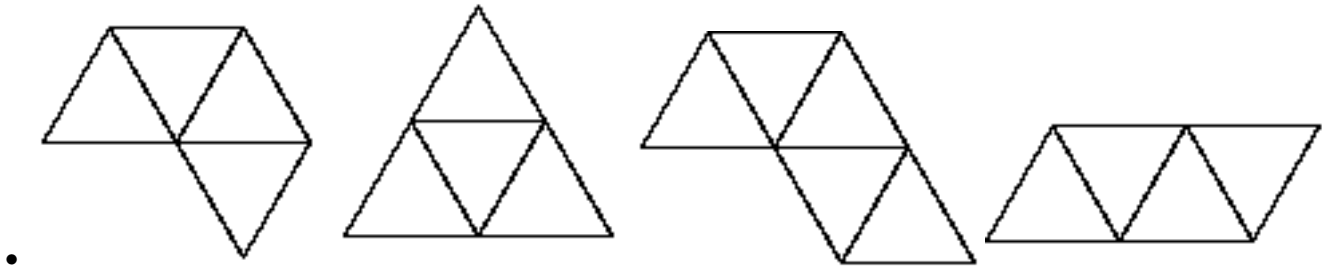
2. **Tetrahedron:**

The large yellow triangle can be used to make a *tetrahedron*. The word “tetra” refers to the fact that this solid has 4 faces.

- (a) First connect the midpoints of the sides of the triangle using a ruler. (The midpoints are the points that divide each of the triangle’s sides in half). How many smaller triangles did you get?
- (b) Now fold the picture along the sides of the small triangle which is in the center. The shape you are able to glue after this is called a **tetrahedron**.
- (c) Look at the faces of this tetrahedron. Are there faces of different shapes? Why or why not?

- (d) Are there faces on a tetrahedron that you can call “opposite”?

- (e) Make a tetrahedron out of toothpicks and clay. First decide how many toothpicks you will need for the edges and how many small balls of clay you will need for the vertices.
- (f) Imagine that you would connect the centers of all of the tetrahedron’s faces. What shape will you get?
- (g) Which of the following nets also represent a tetrahedron? Which ones do not?



3. Prism

The next shape you will be able to make is **Triangular prism**. It is called “triangular” since its top and bottom faces are triangles.

- (a) Place the net horizontally (so that one of the triangles is above the three rectangles and one is below). Mark the “top” vertex of the upper triangle by A . Mark the lower left corner of the rectangle in the center by B . Connect (using a dashed line) points A and B .
- (b) Glue the net into a triangular prism.
- (c) What does the dashed line connecting points A and B on the surface represent?

(d) Are there any pairs of “opposite” sides in the triangular prism? How many?

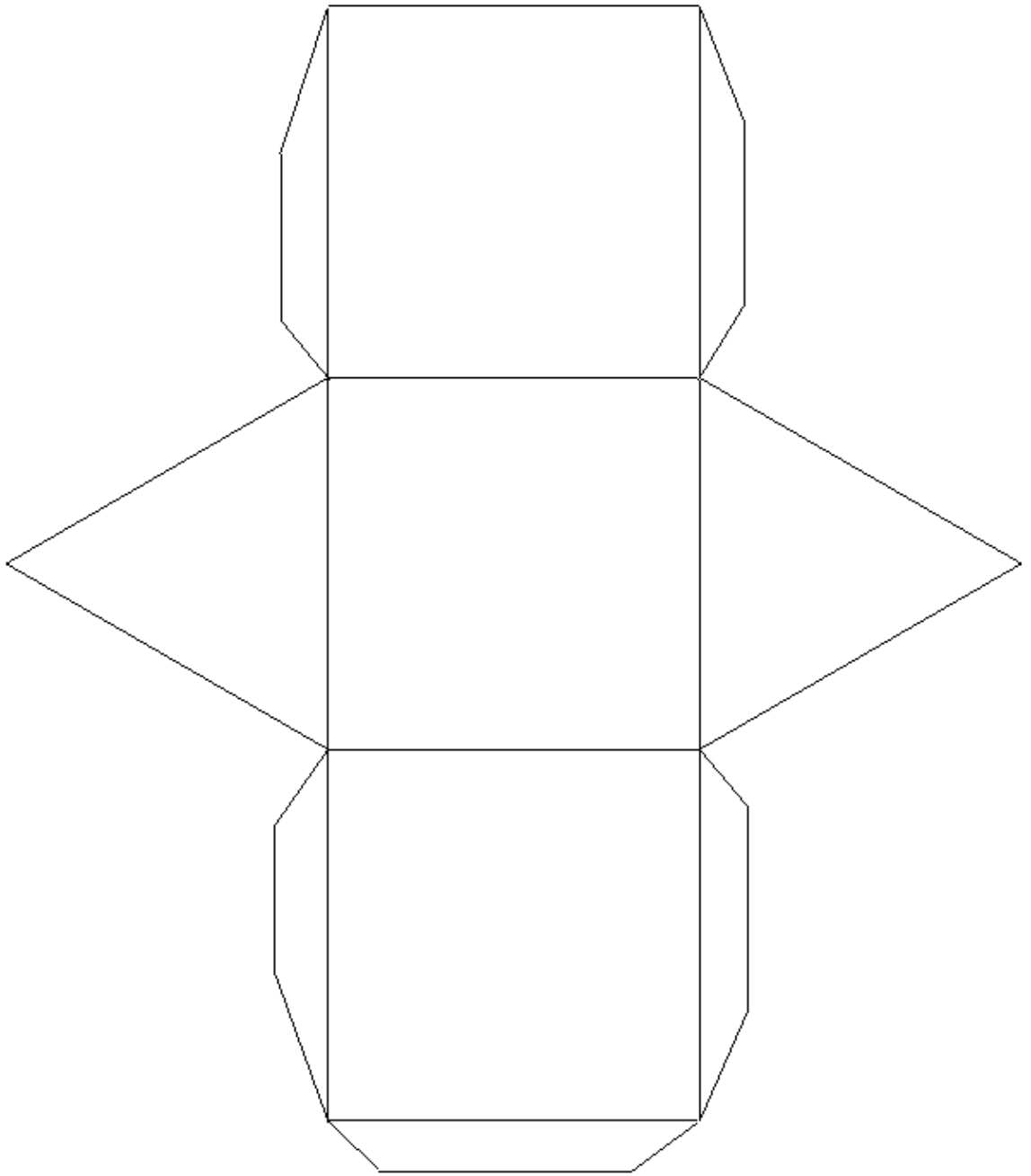
(e) Suppose you would want to build a prism whose top and bottom are not triangles but squares. How many “side faces” would this shape have? Can you identify it with one of the shapes we have seen before?

(f) Make a triangular prism using toothpicks and clay. First decide how many toothpicks you will need for the edges and how many small clay balls you will need for the corners.

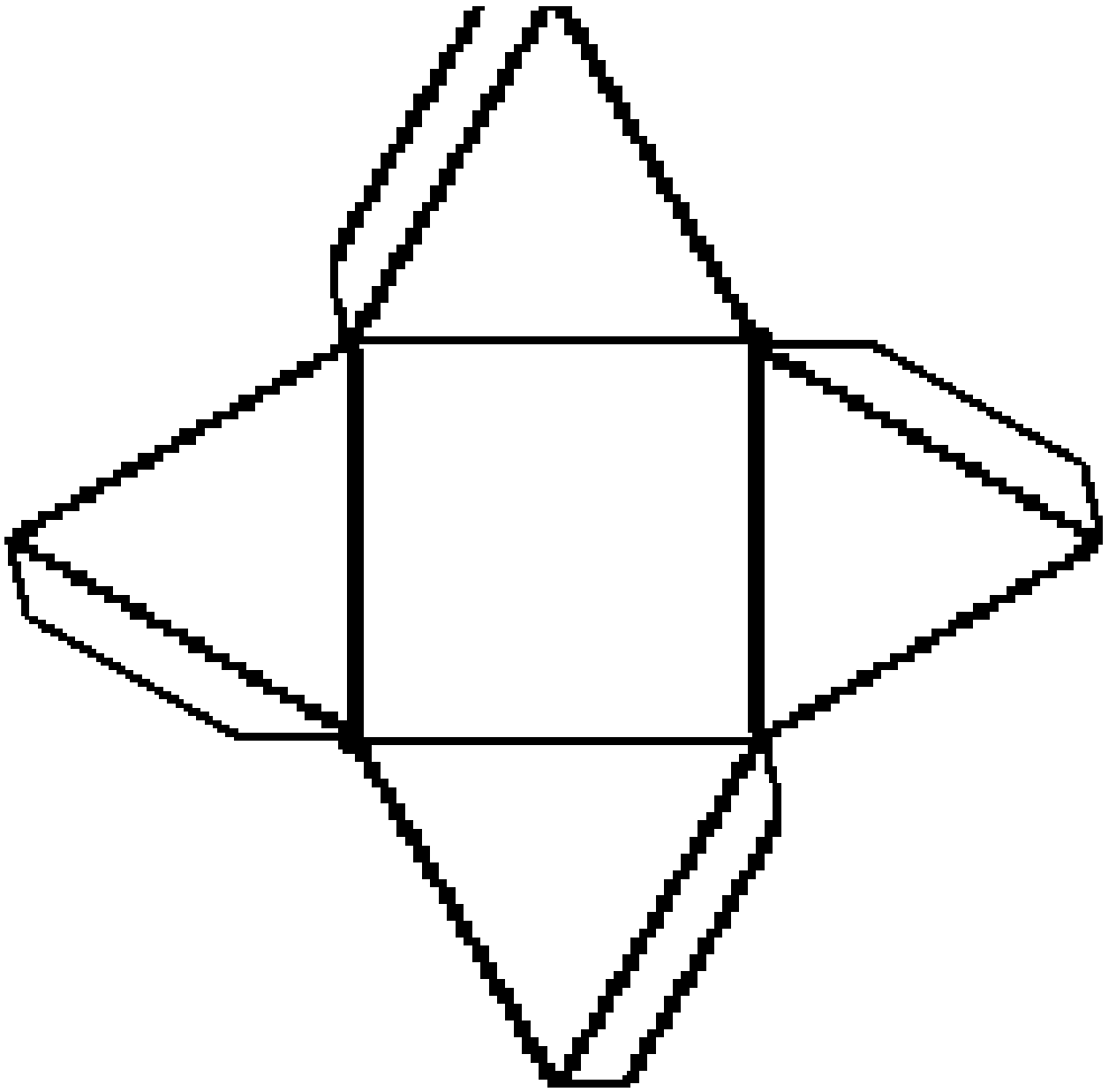
4. Pyramid

If you ever saw pictures of the ancient Egyptian pyramids, you are already familiar with the type of pyramid we are going to make now.

- (a) Before gluing the shape, mark the faces that are going to be opposite using identical pictures. (E.g., use circles for one pair of opposite faces and small squares for the other pair of opposite faces).
- (b) Glue the unfolding into a pyramid.
- (c) What is the shortest way from the top of the pyramid to the center of the bottom square? (You can move only on the surface of the pyramid).
- (d) Make a pyramid using toothpicks and clay. First decide how many toothpicks you will need for the edges and how many small clay balls you will need for the corners.



(e)

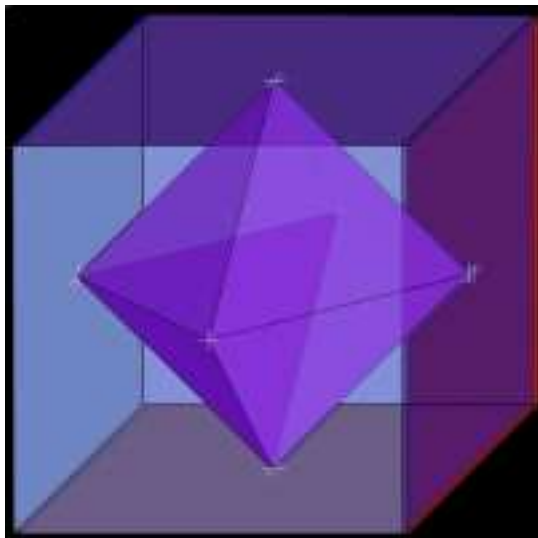


(f)

5. Octohedron

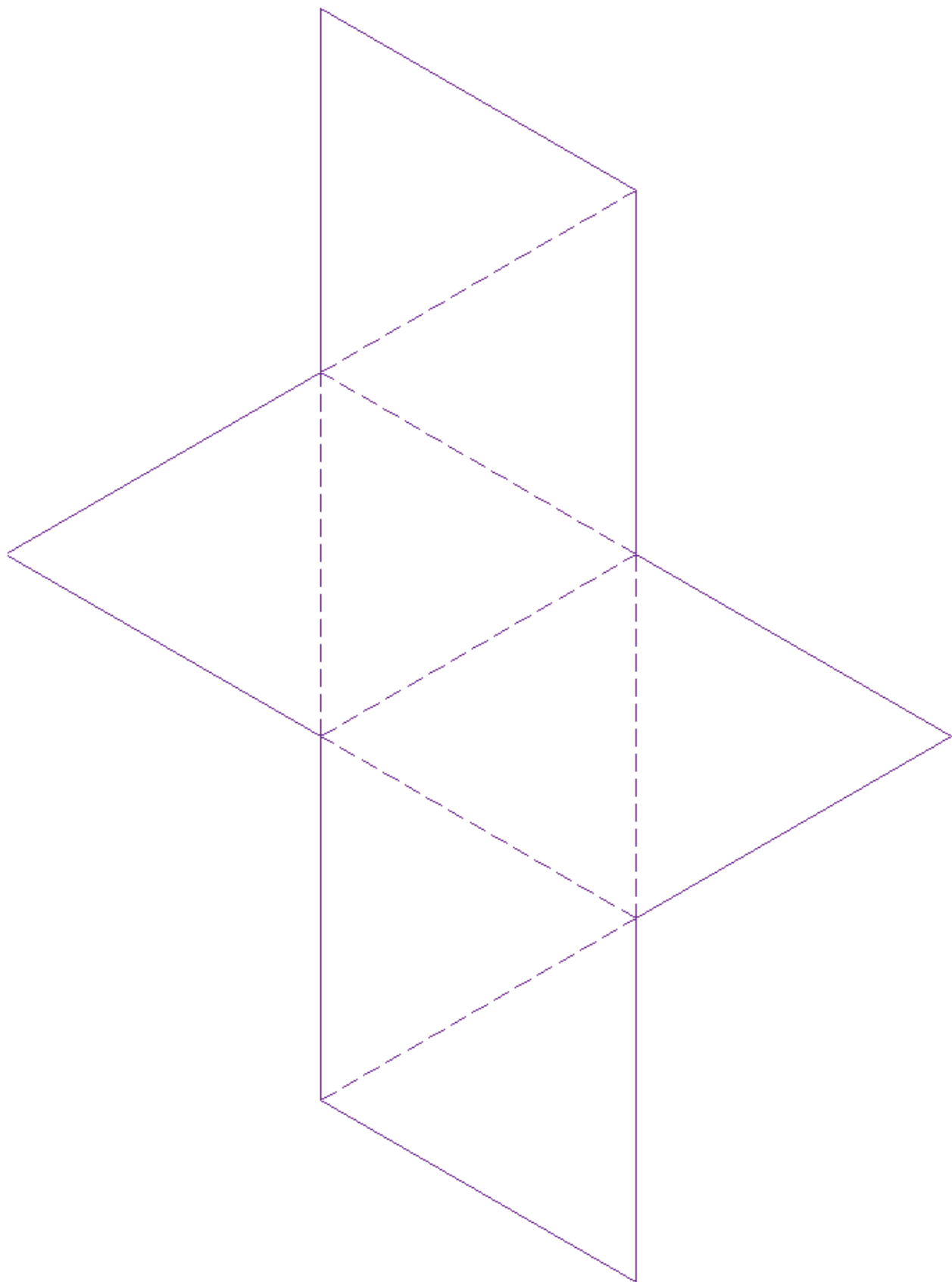
Octohedron looks like two pyramids glued at their bases. One looks up and one looks down. The word *octo* refers to the fact that there are 8 faces.

- (a) Make an octohedron out of each of the 2 net provided.
- (b) Take one of the models of a cube that you have made earlier. What shape will you get if you connect the centers of all faces? (In other words, what is the solid body whose vertices are centers of the faces of a cube?) The picture below may be helpful:

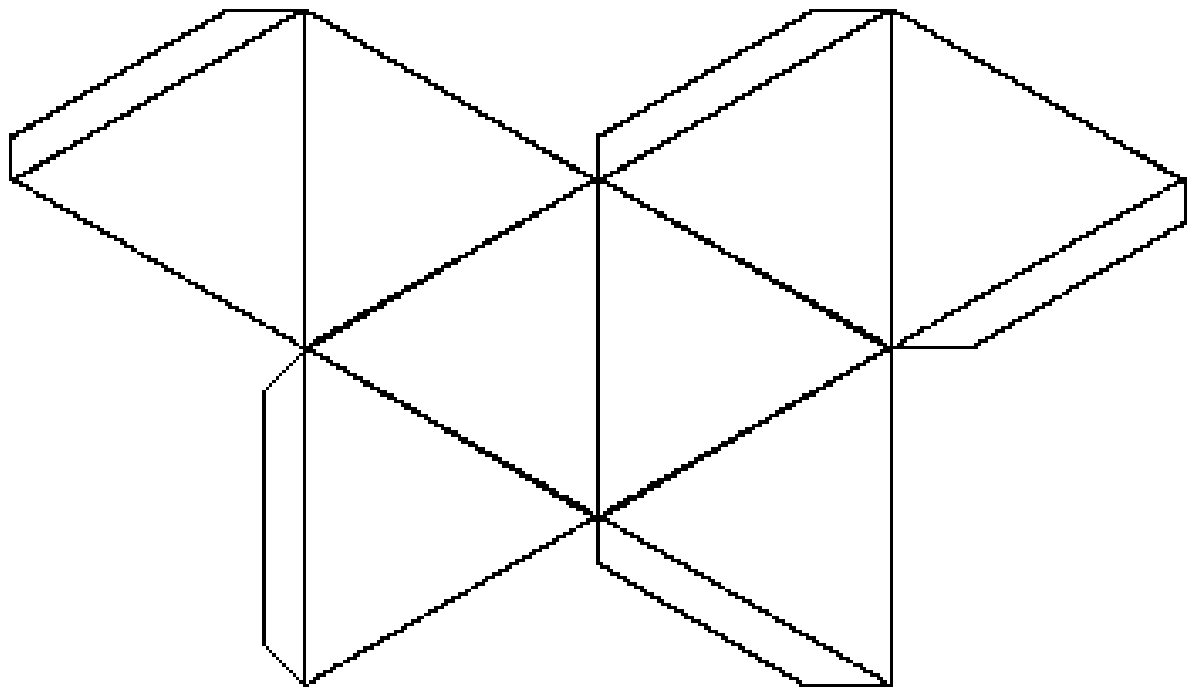


- (c) Are there any pairs of “opposite faces” in octohedron? Can you mark them (be careful not to damage your model!)

- (d) Make a model of an octohedron using toothpicks and clay.



(e)



(f)

6. The last problem is about several of the solid bodies that you have made today.

(a) For what shapes do you have exactly 3 faces meeting at each vertex?

(b) Are there any shapes such that 4 faces meet at some of the vertices?

(c) What is the number of edges that can meet at a vertex in different shapes?

(d) A “tower” is a solid obtained by putting a pyramid on top of the cube. (The base of the pyramid has to be the square of the same size as any of the cube’s faces). Can you modify a net for the cube to get a net for the “house”? There are several different ways to do it!