

## CHAPTER 6 - PRISMS AND ANTIPRISMS

Prisms and antiprisms are simple yet attractive constructions, and form an interesting addition to the collection of geometric solids. They can adapt readily to unique gift boxes and other types of decorations. Each prism or antiprism begins with two identical regular polygons as bases: the equilateral triangle, square, pentagon, hexagon, octagon, or decagon to name a few.

A prism may be thought of as a box with two identical polygonal faces serving as the top and bottom, with parallelograms for sides. An antiprism also consists of two identical polygonal faces, top and bottom, except that the sides are composed entirely of equilateral triangles and the vertices on the bases do not line-up. In this chapter, we will only be working with uniform prisms and anti-prisms. The prisms will consist of square faces and the antiprisms will have equilateral triangles for faces. Both employ identical regular polygons for bases.

### **Objective:**

Create three-dimensional prisms and anti-prisms.

### **Vocabulary:**

Antiprism  
Base  
Color Spectrum  
Decagon  
Equilateral Triangle  
Face (of a geometric solid)  
Geometric Solids  
Hexagon  
Octagon  
Octahedron  
Pentagon  
Polygon  
Prism  
Regular Polygon  
Square  
Three Dimensional  
Triangular Prism

### **Materials:**

Standard white paper  
Several large sheets of 22 x 29-inch white poster-board (These can be cut in half to the more manageable dimensions of 22 x 14 1/2-inches)  
A straight-edge  
Sharp No. 2 pencils  
A quality compass  
A pair of scissors

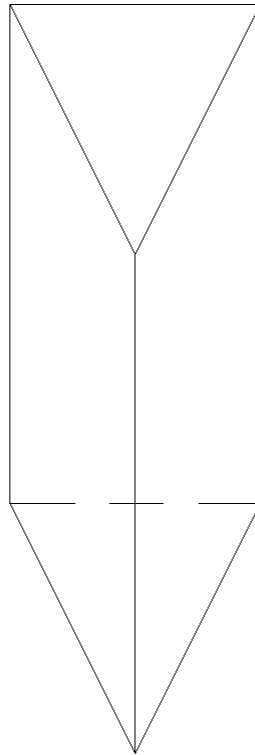
Cellophane tape

An eraser

1/2-inch x 3 1/2-inch white label strips (recommended)

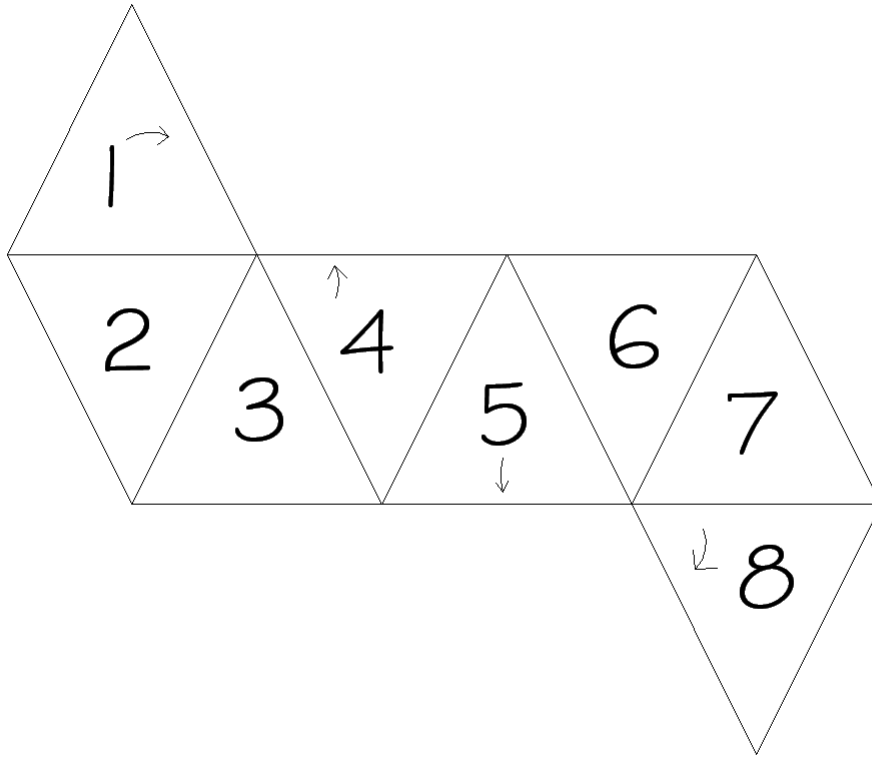
**Steps:**

1. Let's make a triangular prism, using two equilateral triangles and three squares. Affix a square to each side of a triangle, and then lift the squares so that their common edges touch, and tape them in place. The remaining triangle should be placed on top to complete the prism. That's all there is to it. This shape, more than any other, most closely resembles an optical prism, a triangular piece of glass which breaks up or refracts a beam of light into the color spectrum. (**Figure 6.1**)



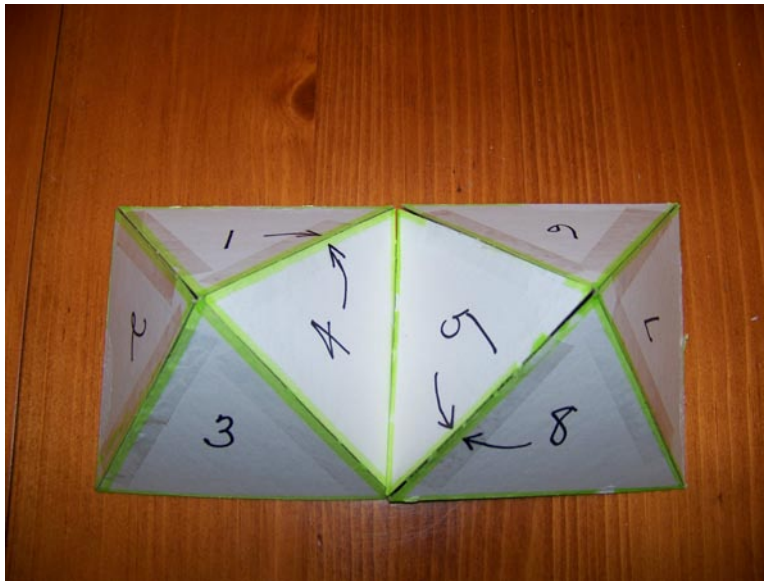
**Figure 6.1**

2. The triangular antiprism is slightly more difficult, and provides an unexpected surprise. For this, eight equilateral triangles are needed. Construct a series of eight equilateral triangles as shown in **Figure 6.2** using the method described in Chapter 3. Score the sides of each triangle with your compass for future folding and cut out the diagram leaving adjacent triangles attached.



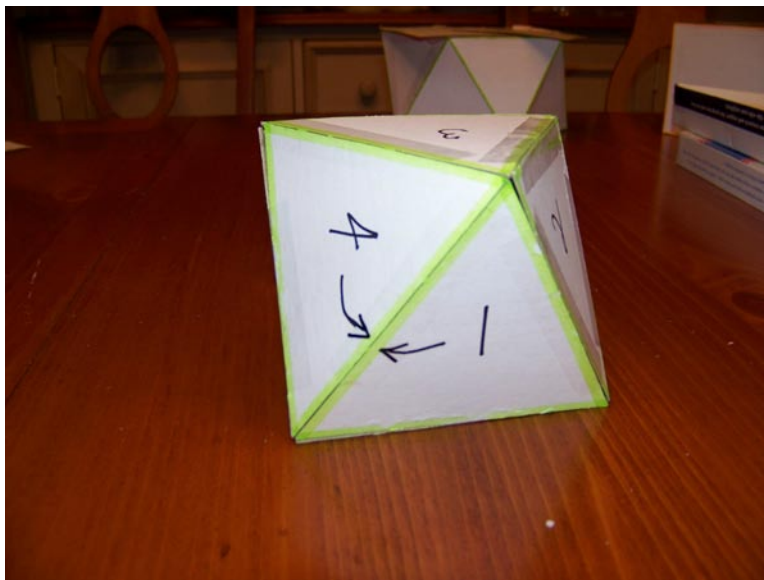
**Figure 6.2**

3. Fold along the scored edges and attach triangle 1 to triangle 4 so that the arrows meet, and tape. Attach triangle 5 to triangle 8 so that the arrows meet, and tape. You will have the two halves of an antiprism. (**Figure 6.3**)



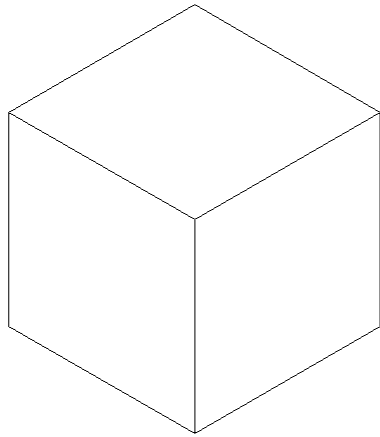
**Figure 6.3**

4. Fold them together and tape to make a solid. When finished, place the object on a flat surface and examine the shape. Yes, it is a true antiprism, fulfilling the requirements - two opposite faces are identical to one another and are rotated so that their vertices do not line up. Every face of the antiprism is a triangle. An antiprism with triangular bases is an octahedron, which is what we have created here. (**Figure 6.4**)



**Figure 6.4**

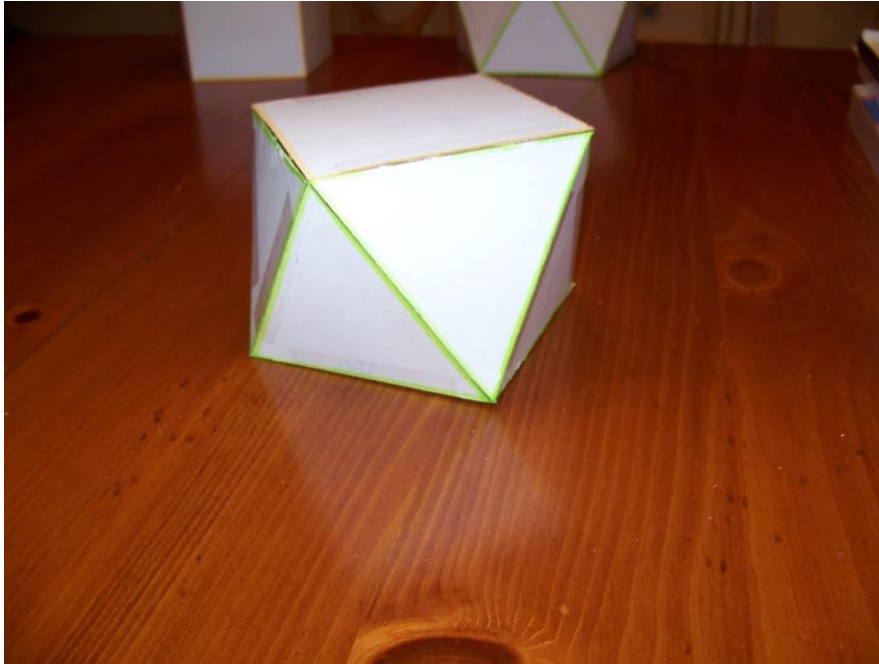
4. The square offers a similar surprise. To make a square prism, six squares are needed. With a square top and bottom and squares for sides, the square prism is also . . . a cube. (**Figure 6.5**)



**Figure 6.5**

5. To make the cube an antiprism, two squares and eight equilateral triangles are required. By creating a loop of eight equilateral triangles in a row, you can see that a square will fit neatly on the top and bottom to complete the square antiprism. Notice that one base is slightly rotated and the vertices do not line-up. (**Figure 6.6**)

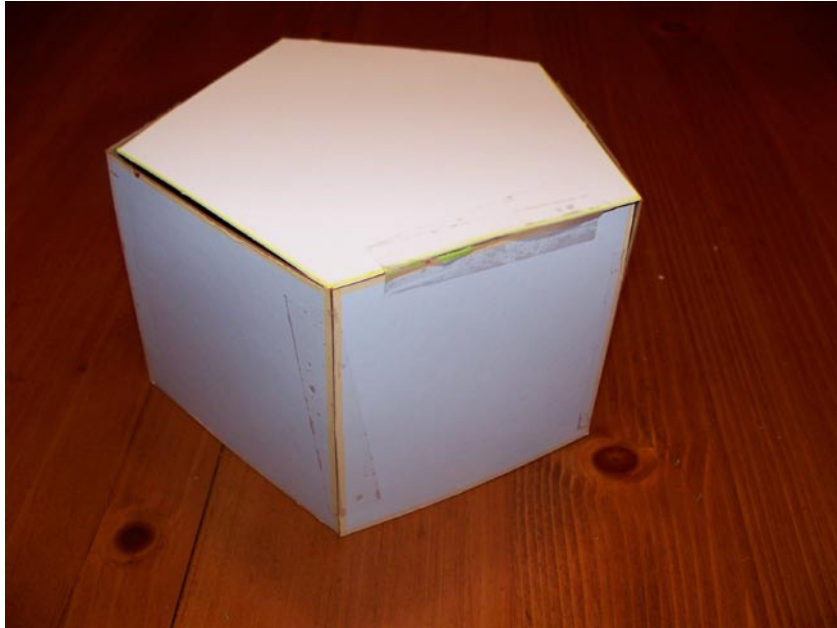
A pattern begins to emerge – if you double the number of faces or sides of a prism, it will take that number of equilateral triangles to create its antiprism. Also, the antiprism twists or rotates slightly because of the angled sides.



**Figure 6.6**

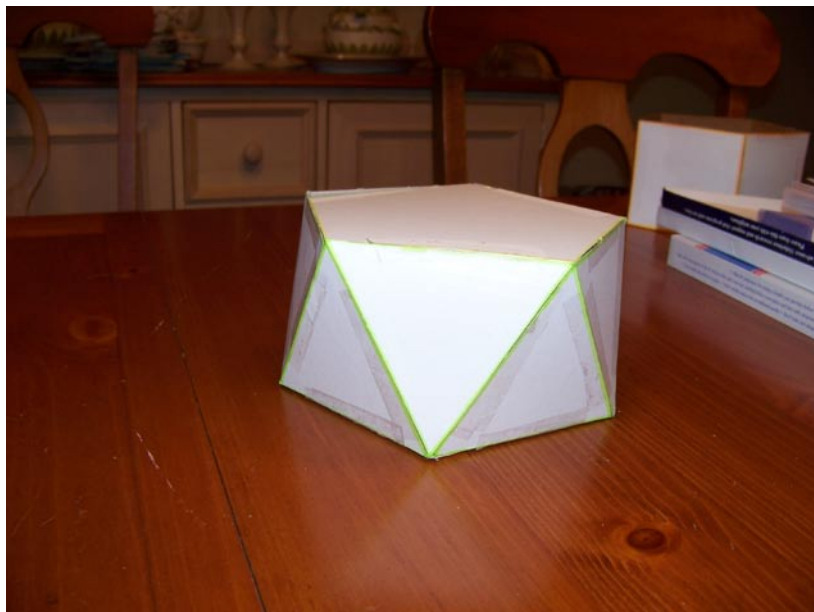
Things become somewhat more interesting with the pentagon. Here, two pentagons and five squares are needed for the prism. Two pentagons and ten equilateral triangles are needed to create its antiprism.

6. For the pentagonal prism, tape a square to each edge of a pentagon, lift the squares and join them with tape along the common edges, and close the prism with the remaining pentagon. (**Figure 6.7**)



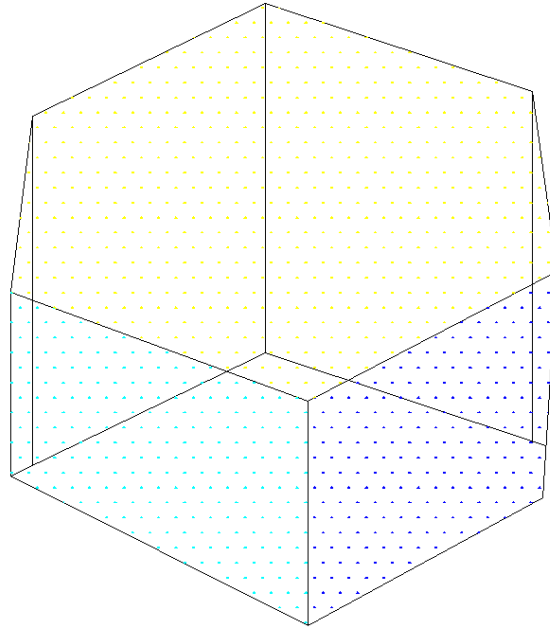
**Figure 6.7**

7. For the antiprism, make a strip of 10 equilateral triangles in a row. A pentagonal antiprism, fulfilling all the requirements will emerge with cover and base, slightly askew. (**Figure 6.8**)

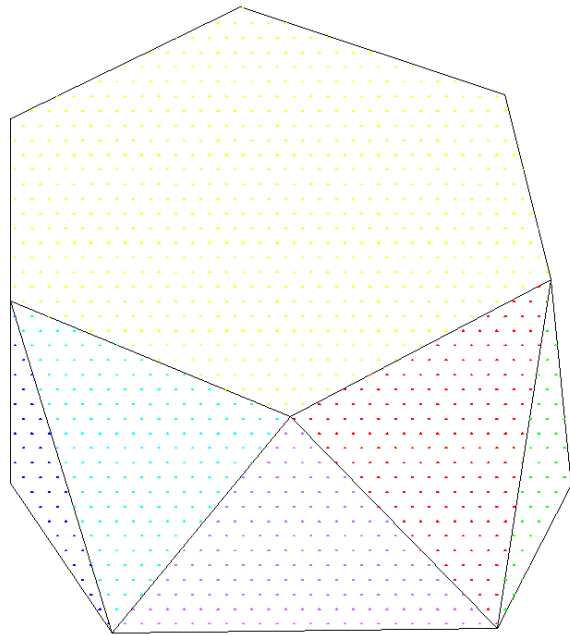


**Figure 6.8**

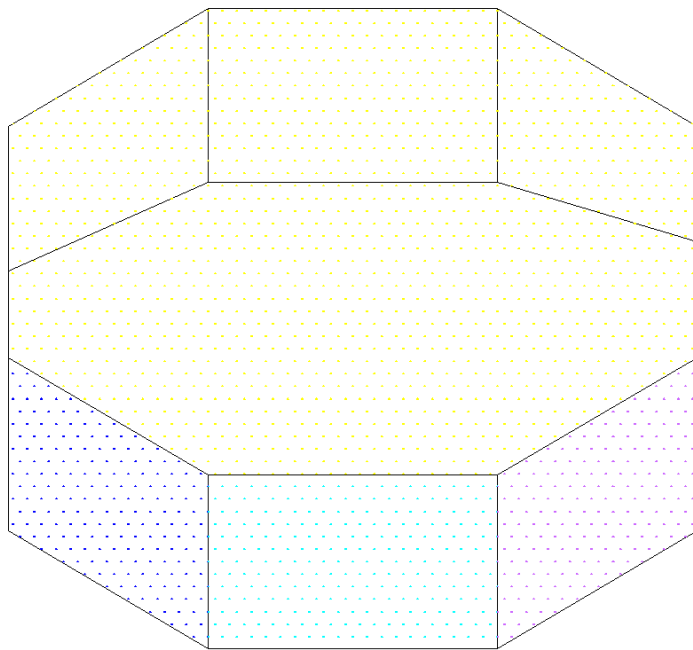
No additional instruction is needed to make the hexagonal and octagonal prisms and their antiprisms. You will probably observe that any attempt to make larger forms is largely redundant and the results are predictable. A set of the basic ten will make an impressive display on your desk or bookshelf. (**Figures 6.9, 6.10, 6.11, 6.12**)



**Figure 6.9**



**Figure 6.10**



**Figure 6.11**

