

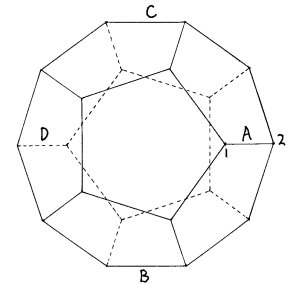
# Instructions for Drawing a Dodecahedron

## Notes for the teacher:

- Once this method for drawing a dodecahedron is understood, a similar procedure can be followed for drawing the icosahedron.
- Before doing this, the students need to understand that an edge of the dodecahedron is drawn to actual size in a particular view only if the edge is parallel to the image plane.

## The Top View:

- Start with ten evenly spaced points on a circle, such that two of the points are placed on the circle's horizontal diameter. In black ink draw the decagon that connects these ten points.
- Draw an inner circle (lightly) that has a radius equal to the length of the side of the decagon (why is this?). Use the five diameters of the decagon in order to mark ten points on the smaller circle. Connect every other point of the inner circle thereby drawing two pentagons inscribed in this smaller circle. Make sure that the pentagon with solid (ink) lines has its left-most edge drawn vertically on the page (because this edge is perpendicular to the front face of the viewing box). The other pentagon is drawn with dotted lines.
- Draw the remaining ten pentagonal faces of the dodecahedrons, some of which are visible (with solid lines) and others are hidden (with dotted lines).



## The Front View: (Read through these instructions before trying them!)

- In the front view, all 20 points of the dodecahedron will be located on one of four horizontal lines drawn across the front view (with 5 points on each line). The five points of the dodecahedron's top face will be placed on the top-most of the four horizontal lines. The five points of the dodecahedron's bottom face will be placed on the bottom-most of the four horizontal lines. The rest of the dodecahedron's ten points will be placed alternately on the two remaining horizontal lines. *Our goal is to determine exactly how far apart the spacing between these horizontal lines must be.* This spacing is not arbitrary!
- Of the dodecahedron's 30 edges, four of them will be drawn to actual size in the front view. These edges are the ones that are parallel to the front face, and are drawn horizontally across the page; they are labeled as A, B, C, D in the top-view drawing, above. The end points of Edge A are labeled #1 and #2.
- In the top view, draw vertical lines (lightly in pencil) through each point that run down through the front view. In most cases, two points share the same vertical line. Label the vertical line through point #2 as line  $\ell$ , and the vertical line through point #1 as  $m$ .
- Point #1 in the front view of the drawing must be located on line  $m$ . Choose point #1 to be about one inch from the top of the front view. (The rest of the points of the dodecahedron have now been determined.) Lightly draw a horizontal line through point #1, and locate the positions of the top face's other four points along this horizontal line.
- Now, we need to determine the location of point #2 in the front view, which will thereby determine the spacing between the top two horizontal lines. The location of point #2 in the front view is determined by two things: the length of edge A must be actual size, and point #2 must be located on line  $\ell$ . To do this, we set our compass to the length of any edge that is of actual size in the top view drawing (i.e., any edge of the top face), then place the compass needle on point #1 in the front view drawing, and mark the place where point #2 must be located on line  $\ell$ .
- Lightly draw a horizontal line through point #2, and locate the positions of the other four points of the dodecahedron that must also appear on this same horizontal line. (These four points, along with point #2, are all at the same elevation above the table on which the dodecahedron sits.)
- In the same way that we used edge A to determine the spacing between the top two horizontal lines, we can now determine the spacing between the middle two horizontal lines by using edge B (or C), and we can determine the spacing between the bottom two horizontal lines by using edge D. Again, the key to this stems from the fact that these edges appear in actual size in the front view.
- It is interesting to note that the distance between the top two horizontal lines (and the bottom two horizontal lines) should be equal to the radius of the smaller circle in the top view drawing. And the distance between the two middle horizontal lines is equal to the difference of the radii of the two circles in the top view.
- Once the placement of the four horizontal lines has been determined, the rest of the front view, as well as the side view, can easily be completed according to the normal procedures and expectations.

