Revisiting Mat Board Models for A Physical Proof of Five and Only Five Regular Solids or Polyhedron

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Abstract

Physical models are invaluable aids for visualizing concepts clearly in space. In this paper mat board built more stable physical models. Polygons, polygon corners, and polyhedra are used to present a physical proof of regular solids. A physical proof shows five and only five regular corners, and subsequently five regular solids.

1. Introduction to Polygons

An understanding of these solids is achieved when students make physical models and handle these models. The models are made using mat board, which is stronger than poster board, which improves the durability of the models [Fig. 1]. Regular polygons are the simplest of two-dimensional shapes having straight edges and equal length sides [Ref. 1, 2, & 3]. An equilateral triangle, a square, and a regular pentagon, [**Fig. 1**], were used to construct regular corners in this paper. Polygons were traced and cut with a cleaver.

Figure 1: equilateral triangles, squares, pentagons, traced, and cut with a cleaver.

2. Polygon Nets for Polyhedra

Nets of regular polygons produce regular polyhedra [**Fig. 2**]. Two different nets produce a tetrahedron. Eight equilateral triangles produce an octahedron, and twenty equilateral triangles produce an icosahedron. For the remaining platonic solids squares produce a cube, and pentagons produce a dodecahedron.

Figure 2: 4 triangles each for 2 nets, 8 triangles, 20 triangles, 6 squares, 12 pentagons.

4. Regular Polygons Used to Form Corners for Regular Solids

Equilateral triangles form three regular corners in [**Fig 3**] for a tetrahedron, an octahedron and an icosahedron. Three squares form a corner for a cube and 3 regular pentagons form a corner for a regular dodecahedron

Figure 3: a tetrahedron, a cube, a octahedron, an icosahedron and a dodecahedron

5. Handling a Regular Polyhedron

If we hold a regular polyhedra between our fingers in [**Fig 4**] we can see each of its vertices, edges, and faces.

Figure 4: fingers touching vertices, edges and faces for five regular solids

6. Conclusion

I have presented a spatial proof using physical models to a wide range of students over many years, and I have been well received by both students and teachers. The teachers have shown their appreciation by wanting to keep the models for their classrooms to serve as constant examples for future study. Once, when I presented the models and the proof to seventh and eight grade students, they wanted to take the proof home to their parents in order to prove a point for themselves.

Emphasizing the tactile experience of handling each of the regular solids provides students with a recognizably different experience than merely viewing three-dimensional images of the regular solids on a piece of paper or on a computer screen

References

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