

Geofix Shapes & Spatial Visualization

The National Council of Teachers of Mathematics in the Principles and Standards for School Mathematics recommends using hands-on activities with manipulatives to teach students basic concepts about geometry, particularly spatial visualization with three-dimensional figures. If students have the opportunity to build three-dimensional figures and explore the relationships among them, they will have a better conception of the basic structures of these figures and be prepared to understand relationships about them that are presented in a more formal context.

HEXAMINOES...

Hexaminoes are plane figures made up of 6 squares, each of which shares at least one side with a side of another square.

1. Using six square geofix shapes and the graph paper provided, draw all of the different hexaminoes. Different means that one cannot be the reflection or rotation of another.
2. A German artist named Albrecht Dürer (1471 - 1528) was the first person to use the term "nets" to refer to the flat 2-D drawings of an unfolded polyhedron. Determine which of the hexaminoes that you discovered in problem 1 could be folded into a cube with no open sides. Try and determine which of them work first and then color the opposite sides with the same color, making what is known as a "color net". Then, make them with your geoshapes and see if they do indeed form a cube. Check your colors to see if they were right.
3. Extension 1: Make a poster as a brain teaser for your classmates. Show all of the nets you discovered that make the cube and add four that don't. Challenge a person looking at your poster to pick out the counterfeit nets.
4. Extension 2:
 - Instead of Hexaminoes, use Pentominoes (shapes made with 5 instead of 6 squares - same rules) and sketch all the possible pentominoes on graph paper.
 - Then, determine which would make a box with an open top.
 - Identify the bottom of the box (side opposite the open side) by placing a "B" in that box.
 - Using geofix shapes - 4 of one color and one (to represent the bottom of the box) of another color, test your patterns.
 - Choose your favorite net and circle it...the "plus" is off limits.
 - Using mini boxes of milk duds, tape one end of the box closed and open the other end, tear off the flaps, and eat the milkduds. Cut the milkdud box *carefully* to create your circled net. Were you successful?

Growing Solids

You've made a cube with six square geofix shapes. Now, double the size by doubling the length of each side of the cube. How many geofix squares would you need to build it?

Make a tetrahedron - a platonic solid that is made from 4 equilateral triangles. What if you double the length of each side of this solid? How many equilateral triangles would you need to build it?

Build the "double cube" and build the "double tetrahedron" to check your predictions. How many of the small cubes will fit in the "double cube"? How many small tetrahedrons will fit into the "double tetrahedron"?

For every polyhedron and its enlargement, there is a pattern to the relationship between the ratio of the edge lengths and the ratio of surface areas. See if you can find it.

For every polyhedron and its enlargement, there is also a pattern to the relationship between the ratio of the edge lengths and the ratio of their volumes. See if you can find it.

PROBLEM: Candy works for the Chocdud company. Currently the company markets Chocduds in two different-sized boxes. Candy has been bombarded with requests for a super-sized box and her boss agreed that she could produce a box that is twice the size of the large one. Her boss told her to double the order (used for the large box) for the candy and the cardboard to build the box. What should Candy tell her boss? Is "thank you" enough?

