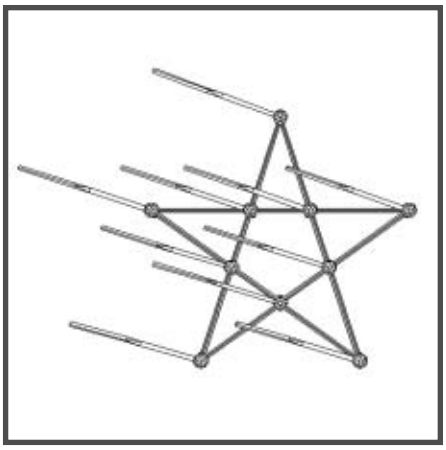
Zome System

Builds Genius!

Speed Lines!

Mathematics / Physics / Art
Basic Concept

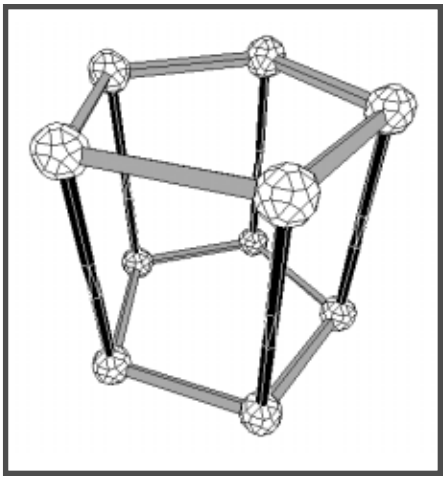
Lesson Objective:
Students will learn about polygons, parallel lines, and prisms. They will deepen their understanding of the relationship between 2 and 3 dimensions through the use of "speed lines."



Prerequisite Skills:
Knowledge of basic 2 and 3 dimensional geometric forms ("Geometric Shapes," "Geometry is All Around Us," "Shape and Number," and "2-D and 3-D Shapes").

Time Needed:
One class period of 45-60 minutes.

Materials Needed:
- Two Zome System Creator Kits for up to 25 students
- Overhead projector



Procedure:
At least one day before this exploration, show your class some illustrations of "speed lines" as they appear in illustration, company logos, etc. Ask each student to bring in at least one example of speed lines from the comics, old yellow pages, packaging, old magazines, the Internet, etc. On the day of the exploration, divide the class into teams of 2 students. Distribute the Zome System pieces evenly. Each team is to build a flat closed shape. A brief discussion on the meaning of "flat" and "closed" may be appropriate as an introduction to the concept of a polygon. For this exploration, it's enough to know that "flat" means that when the shape is laid on a table, all nodes in the shape will touch the table without being forced, while "closed" means that the nodes and struts form a loop without crossing each other. However, the shapes need not be convex; for example, both the shape of a pennant and a

star are acceptable.

Now ask students to imagine that they are working with Zome System in the space shuttle. They can let go of their shape and watch it float in a straight line from one side of the cabin to the other. Have each student choose a direction for the shape to "float", and insert a strut in any node to indicate the direction the shape is moving. The strut should not be in the same plane as the shape, i.e. it should not lie flat on the table with all of the other parts in their shape. Ask for one or more volunteers to show how their shapes float through space in the direction of the strut they inserted.

Now discuss the examples of speed lines the students brought in. *Do all speed lines have things in common? Are they all the same length? Do they all go in the same direction? What are speed lines trying to show? Is there a relationship between speed lines and time? Is there a relationship between speed lines and space? Where was the object in the example before it moved? Where is it now? Are speed lines always the same size as the shape they come off of?*

When the class reaches general agreement on the nature of speed lines, challenge them to build speed lines on their shapes to show which direction the shape is floating through space. Next they should put nodes on the ends of all their speed lines and connect the nodes together with struts.

Conclude the exploration with a discussion of the different concepts your students encountered, including speed, parallel lines and prisms (the overhead projector can be useful to discuss particular models). *What happens if a shape floats through space in one direction for a second? a minute? a year? What happens if it's going slowly? quickly? What is the relationship between the shape "on top" and the shape "on the bottom" of your model* (if the "speed line" struts are parallel and of the same length, the shapes will be identical)*? Does the shape on top have to be the same as the shape on the bottom? Why, or why not? What is the name of an object consisting of two identical polygons connected by parallel lines* (a prism)*?*
Students should draw pictures of their shapes, with speed lines, in their math journals, and to write down observations and conclusions.

Assessment:
Observe students while they work, and review notes in journals. To meet the standard students must build a prism consisting of two identical polygons with connecting parallel lines. To exceed the standard they must make observations of how speed lines represent movement, velocity, and time.

Standards Addressed:
* Physical Science standards addressing concepts of velocity and Newtonian motion.
* Mathematics standards addressing mathematical connections (NCTM Standard 4).
* Mathematics standards addressing geometry and spatial sense (NCTM Standard 9).

Transfer Possibilities:
More exploration of the relationship between 2 and 3 dimensions in mathematics, art, and science ("3-D Triangles," "Cubes - I," "Cubes - II," "Cubes - IIIA," "Cubes - IIIB," "3-D Triangle Tiles").