MATHEMATICS

# Geometry Is Made a Game

**Flexible geometric models illustrate theorems which make it easy to learn the laws of triangles. The idea was born about a year ago.**

By MARTHA G. MORROW

➤ GEOMETRY a tough subject?

Not if you make models out of elastic from a lady's old hat, two pencil stubs, a screw eye, a nail and several pieces of cardboard.

In a few minutes anyone can build demonstrations that will "Q. E. D." to any teacher's delight.

Some of the country's leading mathematicians are working together to turn geometry into an exciting game. More than 10,000 kits are being distributed in cooperation with the National Council of Teachers of Mathematics.

The flexible models can be put together in a matter of minutes. Dark elastic represents two sides of the triangle and a printed line forms its base. By looping the elastic over a small nail stuck at various points in a piece of cardboard, a wide variety of triangles can be made.

If you have already mastered plane geometry, these will help refresh your memory. If geometry is still something you will study in the future, these flexible diagrams will help you understand some of the fundamentals. And in any case, they are fun to play with.

## Model Proves Theorem

Remember the old theorem saying that triangles may be long and thin, or fat and squatty, but if their bases and altitudes are equal, they will have the same area. One of the models lets you see that this is true.

Did you ever question that a line connecting the mid-point of two sides of a triangle would be parallel to its base?. If so, one of the flexible models was made specially for you. And if, after forming various triangles merely by rotating a black pencil, you are still an "unbeliever," you can take out a ruler and actually measure the distance between the two lines.

The idea of making a game of geometry was born about a year ago. Its parents (and it has more than two!) are all geometry teachers. Dr. E. H. C. Hildebrandt loves to amuse his friends with collapsible figures demonstrating various phases of geometry. Prof. M. H. Ahrendt of Anderson College is an old hand at devising ingenious ways of making mathematics a vivid, living subject. These two thought up the idea of putting into a kit the few simple materials needed to make a series of models.

But the feminine touch was lacking until Miss Frances M. Burns of Oneida (N. Y.) High School was called on to design several models. Just like a woman, she used scraps to produce a tricky set of flexible diagrams.

Science Service, an old hand at assembling actual specimens and working up experiments to be done with them, was persuaded to issue a trial set of these kits.

A half dozen kits made their debut at the recent annual convention of the National Council of Teachers of Mathematics in Baltimore. They were immediately recognized as a tailor-made aid to visual education. The idea caught like wildfire, and the committee drew heavily on its backlog of units to supply geometry teachers with a means of getting and keeping the interest of the entire class.

You can easily make one or two of these models yourself. The few materials you need undoubtedly will be found around the house. When you have completed it a "geometry party" might be in order to show off your masterpiece.

Two parallel lines are the basis of the model designed to show how triangles of equal area may vary greatly in shape. First cut a rectangle three inches wide and five inches long from a piece of stiff cardboard, preferably of a pastel shade.

About half an inch from the bottom of the long side draw a line the entire length of the card. Make it red or some other color that contrasts nicely with the cardboard. About two inches above this and parallel to it, draw another line.

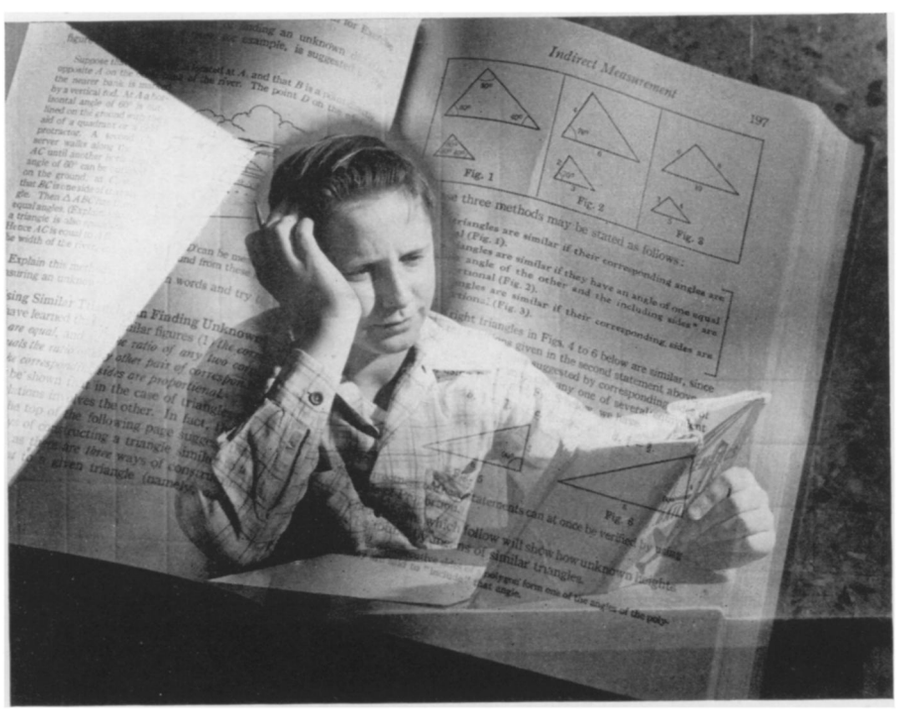
On the lower line, fairly far to the left, mark a point "A." On the same line, about two inches to the right of "A", mark a point "B." Connect with a dotted black line. Select a point "C" near the center of the top line and in red draw lines to A and B. This completes the triangle ABC.

## Permanent Model

To make a really permanent model, back the cardboard with heavy corrugated board, or with very stiff cardboard cut from a packing box. Cut to exactly the same size as the colored cardboard and tape the two together.

With a pin at A and B punch holes through both the cardboard and the corrugated board. Thread a seven-inch piece of dark round elastic through these holes, leaving a generous loop about four and a quarter inches long on the front side of the model. Knot well on the reverse side so the elastic will not pull out. Your model is now complete.

Loop your elastic around a small nail and




*PUZZLING FIGURES—Geometry can be a difficult subject to grasp on the pages of a textbook.*

*VISUALIZING THEOREMS—Geometry can now be fun, thanks to simple but interesting new kits which have been prepared to let you actually see the problems of triangles.*

stick the nail somewhere on the top line, well to the right of C. Does the three-sided figure, made by the elastic and the dotted line AB, seem to have about the same area as triangle ABC?

Try sticking the pin at other points along the upper of the two parallel lines, which is a cute way of being sure that all the triangles have the same altitude. Notice that when the pin is placed far to the right, the triangle is quite elongated; when it is placed near C, it becomes short and fat. In all cases, however, the triangle is equal to ABC in area.

Only one line need be printed on the model that might well be called: "Midpoints of Sides." From your colored cardboard cut a rectangle three by five inches. In the lower left-hand corner start a straight line segment that slopes inward and extends almost to the top of the cardboard rectangle. Mark the upper end-point of the line segment "A," the lower end-point "B," and the exact middle of the line segment "M." Back the rectangle with corrugated board .

To prepare the other leg of the triangle, split in half the stub remainder of a used pencil. A stub about three inches long would be best. This will be easier to do if you slip off the cap holding the eraser, scrape off the paint along the edges where the two halves of wood are glued together and soak in water. Remove the center lead, and paint the wood black.

About a quarter inch from each end of the wood bore holes large enough to take the elastic. To avoid splitting the wood, start the hole with a small nail and complete with a tiny screw. Now bore a third hole midway between these two.

At B and M punch small holes. Thread a piece of elastic five inches long through B and through the hole at the lower end of the wooden stick, and knot.

Thread another piece of elastic three and a half to four inches long through M and through the hole at the midpoint of the stick, pushing it into the wood from the same side as the longer elastic and knot both ends.

Stick a carpet nail through the third hole, and punch it through the cardboard and corrugated board at A. With a pair of pliers bend the end of the nail so it does not pull loose. Rotate the wooden piece to be sure it pivots easily around the nail.

One piece of elastic now forms the base of the triangle and the other connects the midpoints of the other two sides. As you rotate the stick, the elastic lines get closer and closer together, but always remain parallel.

Some geometry kits have been reserved for readers by Science Service.

The four models, all dealing with triangles, may be easily assembled from the materials included. A leaflet suggests a wide variety of experiments to be performed with them, and gives full details for making large demonstration models.

To get one of the kits, send 50 cents to Science Service, 1719 N Street N. W., Washington 6, D. C. Just ask for Geometric Models Kit.

Science News Letter, May 7, 1949



PALEOBOTANY

# No Eden-Like Climate

➤ PICTURES of an earlier, Eden-like earth with a warm, balmy climate evenly distributed all over it and palm trees waving in the Arctic, were declared all wrong at the meeting of the National Academy of Sciences in Washington, by Prof. Ralph W. Chaney of the University of California.

Fifty or sixty million years ago, in the time geologists call early Tertiary, the climate of the whole earth was warmer than it is now, Prof. Chaney stated; but there was marked zonation just the same. Plant fossils collected in the Far North show that it had a temperate climate like that of the central and northern United States, while in what is now the Pacific Northwest conditions were subtropical.

In between these two great vegetational regions there was an intermediate zone. In this there were trees and shrubs representative of the regions on either side, but the dominant tree was the "dawn redwood" or Metasequoia, living representatives of which have recently been found surviving in China. Interestingly enough, the present Chinese Metasequoias also occupy an intermediate position, with cool-temperate trees to the north and warm-climate forests to the south.

The land bridge between North and South America now known as the Isthmus of Panama has been carrying two-way traffic for the past 5,000,000 years, Dr. W. P. Woodring of the U. S. Geological Survey told the Academy. The traffic at first was unevenly divided, with more animal migrants going south than there were going north, he added.

Fossil records show that the very first users of the bridge in both directions were small animals; and Dr. Woodring suggested that these did not even wait for the bridge to be completed, but made their way from island to island, "using still-separated spans and completed piers as stepping stones."

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