# Illustrating with the Overhead

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"Seeing is believing." It is easier to convince a listener if he can see demonstrated that which he has difficulty accepting. This is true whether the topic is sports, politics, oddities of nature, or mathematics concepts.

Most teachers are trained in the implementation of visual aids, and few mathematics classrooms can be found without blackboard compasses and protractors or an assortment of plastic geometric figures. There is another tool available to the teacher. That tool is the overhead projector.

Often the projector is used only to provide occasional drawings, sample problems, or class notes. It can be used more effectively to:

(a) break down learning barriers for students who have less ability in visualizing mathematics concepts;

(b) assist all students in remembering demonstrated properties, formulae, and theorems; and

(c) expedite the process of communicating information.

Of course, in order for the overhead projector to become such an efficient and effective teaching/learning tool, proper materials must be developed. This paper presents four topics, found in the junior high mathematics curriculum, which could be taught using the overhead projector.

## TOPIC ONE: Deriving the Formula for the Area of a Triangle

The teacher can allow the class to derive the area formula for a triangle. First, ask the students to supply the formula for the area of the square outlined on an overhead transparency. Next, place a precut paper triangle inside the square. The students easily recognize the shape of the triangle and recognize that the area of the triangle is one-half the area of the square, or one-half the base multiplied by the height. This process can be repeated using a rectangle or parallelogram in place of the square.

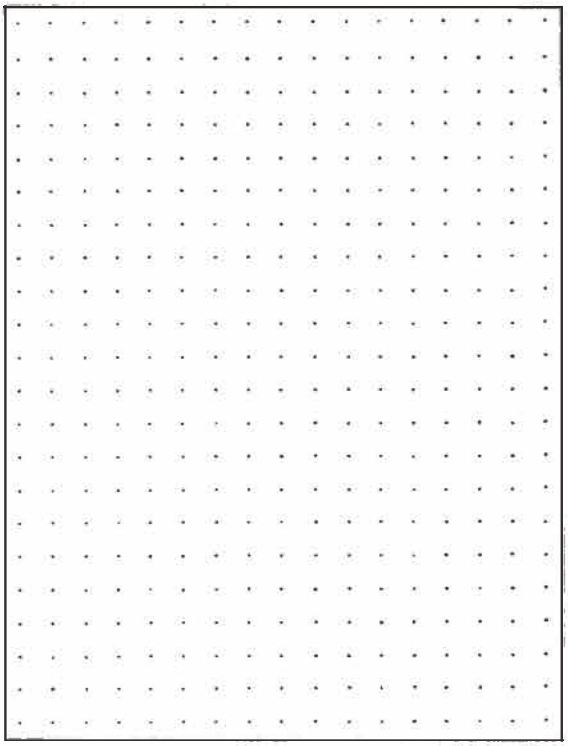
This demonstration assumes that students have learned area formulae associated with the square, rectangle, and parallelogram. The illustration's strength rests in enabling students to visually encounter the relationship between the area of a given triangle and a square, rectangle, or parallelogram. The overhead projector allows this association to be made quickly, yet requires only a few very simple materials.

## TOPIC TWO: Translations, Rotations, and Reflections

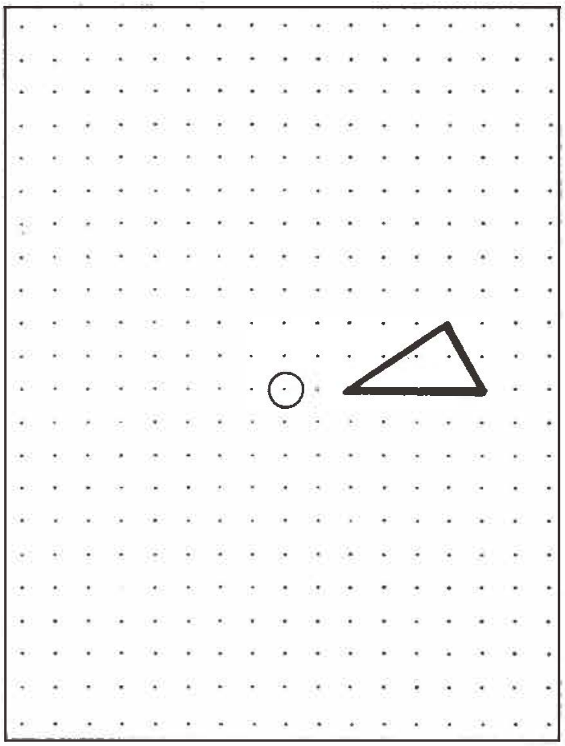
Motion geometry is easier to illustrate on the overhead projector than on the blackboard. To demonstrate translations, a transparency of dot graph paper is constructed (see Sample Transparency #1). Simply by sliding a paper triangle (or other figure) to various points on the transparency, students are able to visualize the process of a translation and the relative orientation of the resultant figure to the original.

A similar process using transparencies and paper triangles would

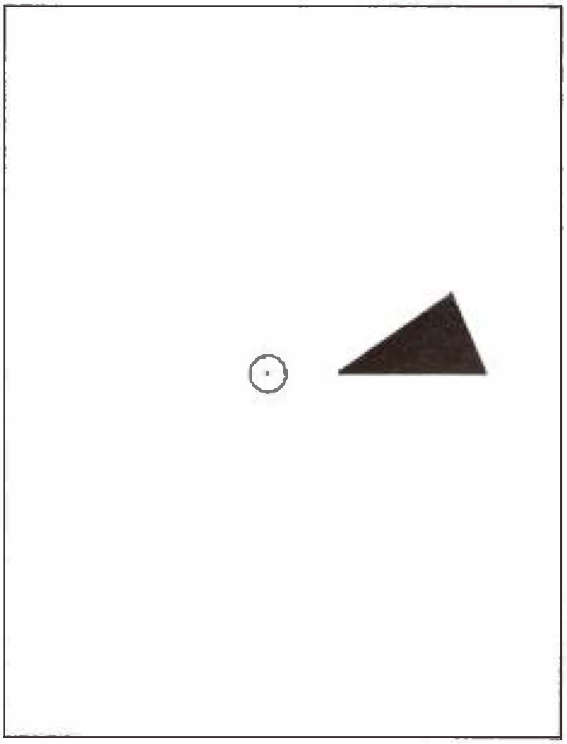
## Sample Transparencies



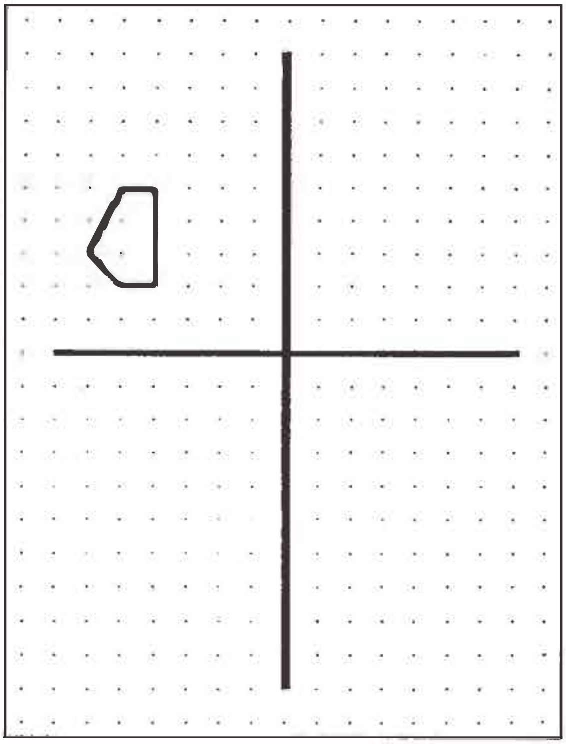
TRANSPARENCY #1



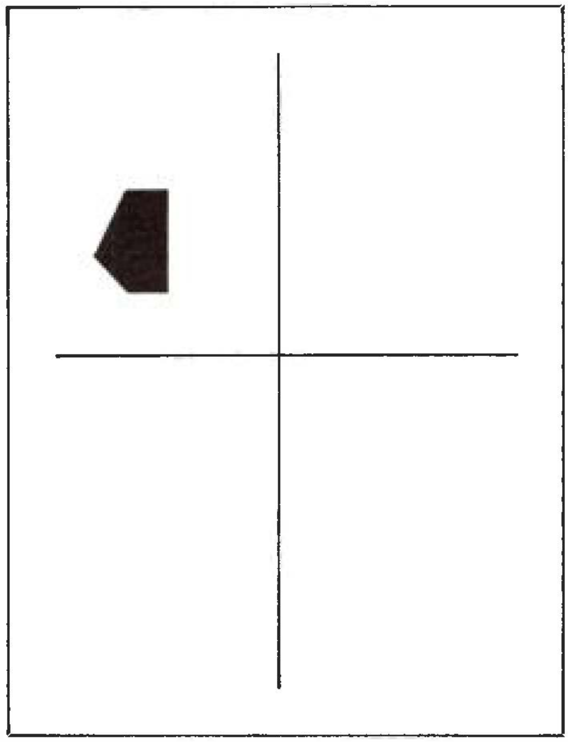
TRANSPARENCY #2



TRANSPARENCY #3



TRANSPARENCY #4



**TRANSPARENCY #5**

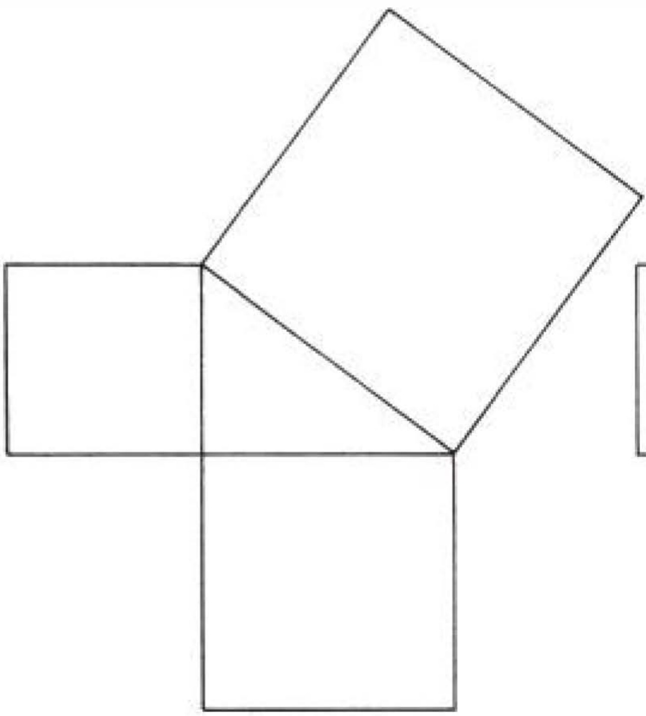


**DIAGRAM 1.**

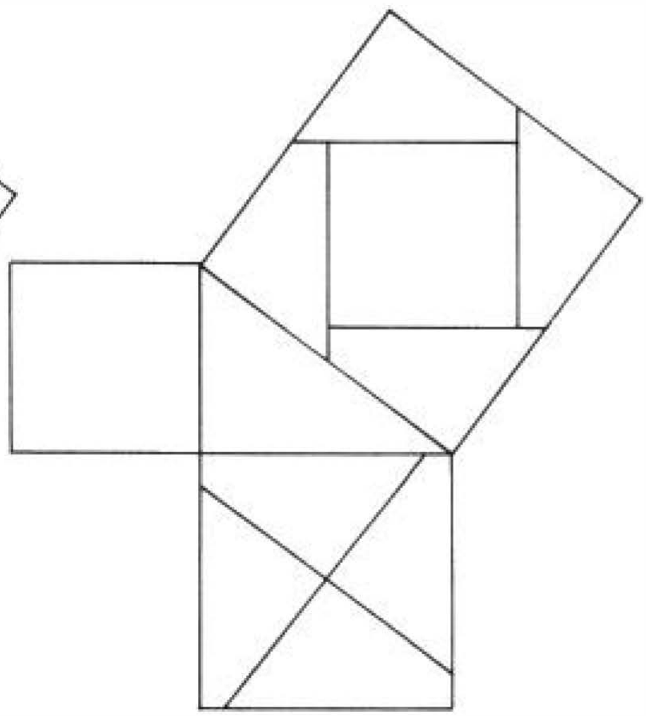


**DIAGRAM 2.**

enable students to visualize the other two forms of geometric motion.

Orientation resulting from a rotation is demonstrated by placing a second transparency on the dot transparency and rotating it about a selected point (see Sample Transparencies #2 and #3). Reflections are illustrated by folding a transparency back upon itself. The fold acts as the line of reflection when the mirror image is created (see Sample Transparencies #4 and #5). Resultant figures can be compared to original figures in terms of location, orientation, direction, and distance from a point of rotation or line of reflection. These comparisons allow students to summarize the intended properties.

## TOPIC THREE: Equilateral Triangles

Illustrating the properties of an equilateral triangle with the overhead projector does not constitute a proof of these properties. At the junior high level, the recognition of these properties is more important than the proof.

Place an outline of an equilateral triangle on a transparency, and then rotate a paper triangle of equal size showing that the paper fits into the outline from three directions. The student concludes that an equilateral triangle not only has three equal sides but has three equal angles. The demonstration is simple, yet effective, and allows students to draw the correct conclusion: an equilateral triangle is also equiangular.

## TOPIC FOUR: Pythagorean Theorem

To show the Pythagorean theorem, a transparency of the figure in Diagram 1 is created. A piece of paper the same size as the square on the hypotenuse must be cut into pieces as shown in Diagram 2. These pieces are rearranged once the theorem is presented, and the squares are identified and labeled to show that the area of the square on the hypotenuse equals the sum of the areas of the squares on the other two sides. This illustration does not prove the hypothesis, but provides students with a visual experience to aid in understanding the theorem and remembering that $a^2 + b^2 = c^2$.

The overhead projector is not the right tool to teach every concept found in the mathematics curriculum, but it can be used for more than simple diagrams or lecture notes. By experimenting with the projector's possibilities, the teacher can assist most pupils to develop better visualization skills while enhancing understanding of many mathematics topics.

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