## If the Shape Fits

Summary
The use of manipulatives helps students create various geometric shapes and measure their area.

## Group Size

Small Groups
Materials

- I Have, Who Has?
cards
Metric rulers
- Trapezoid 1
- Trapezoid 2
- Trapezoid 3
- Trapezoid Shapes 1
- Trapezoid Shapes 2
- Trapezoid Shapes 3
cm graph paper
- Trapezoid Assessment
- Irregular Polygon Overhead Overhead ruler
- Irregular Polygons 1
- Irregular Polygons 2
- Irregular Polygons 3
- Irregular Polygons 4
- Irregular Polygon Assessment

Additional Resources
Books
Math on Call, A Mathematics Handbook, by Great Source Education Group; ISBN 0-669-45770-1

## Background for Teachers

This two-day activity involves the composition and decomposition of trapezoids and irregular polygons. A trapezoid is a quadrilateral with exactly one pair of parallel sides. An irregular polygon is a closed figure whose sides are not all the same length.
Before teaching this lesson, students need to know how to find the area of squares ( $b \times h$ ), rectangles ( $b \times h$ ), parallelograms ( $b \times h$ ), and triangles ( $12 \mathrm{~b} \times \mathrm{h}$ ). They should also be familiar with using rulers to measure in centimeters.

Intended Learning Outcomes
2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics. 1

Instructional Procedures

Invitation to Learn
Play I Have, Who Has? with your class. You may need to remind them how to find the area of squares, rectangles, parallelograms and triangles.
Instructional Procedures
Day One
Hand out Trapezoid 1 and Trapezoid Shapes 1 to one third of your students. Do the same thing with Trapezoid 2 and Trapezoid Shapes 2, and then Trapezoid 3 and Trapezoid Shapes 3.
Have students cut out the shapes on their Trapezoid Shapes pages.
Have them find which shapes fit together to make their trapezoid.
Once they know which shapes make their trapezoid, have them measure (with a ruler and using $\mathrm{cm})$ the base and height of each of those shapes. Tell them to use their measurements to find the area of each shape.
After they have found the areas of their shapes, ask them how they could use the area of those shapes to find the area of their trapezoid.
Discuss ideas.
Have students figure out the area of their trapezoid.
In their journals, have students draw a trapezoid and describe how to find the area of it by dissecting it into familiar shapes.
Hand out cm graph paper to each student.
Have them create their own trapezoid using squares, rectangles and triangles.
Tell the students to figure out the area of their trapezoids.
Have students switch their trapezoids with a partner and find the area of the new trapezoid.
Have partners compare answers and discuss their findings.
Have students complete Trapezoid Assessment.
Day Two
On the overhead, show your students the Irregular Polygon Overhead. Ask students if they have any ideas of how to find the area of the polygon.
After the Day One activity, they should realize they can break the polygon into triangles, squares, rectangles or parallelograms. Then they can find the area of each shape, and then add all of the areas together. That will give them the area of the irregular polygon.
Have volunteers come to the overhead and demonstrate how they could break up the polygon into different shapes.
With an overhead ruler, demonstrate how to measure each shape using centimeters.
As a class, find the area of each shape, and then add the areas all together to get the area of the irregular polygon.
Hand out Irregular Polygons 1 to 14 of your students, do the same with Irregular Polygons 2, Irregular Polygons 3, and Irregular Polygons 4.
Have students draw lines to break their polygons into triangles, squares, rectangles, and parallelograms.
Have them measure (with a ruler and using centimeters) each shape, find its area, and then add them together to find the area of their irregular polygon. Write that area in their journal.
Have students cut up their polygon up into the new shapes they created.
Have them switch their shapes with a partner.
Have partners create a new irregular polygon with those shapes and glue it into their journals.
Measure each of the shapes, find its area, and then add them together to find the area of the new irregular polygon.
Have partners compare results. They should find that the area of the original polygon and the area of the new polygon are the same.
Discuss their findings. Even though the shape changed, the area remained the same.

In their journals, have students explain how they find the area of irregular polygons. Have them use the irregular polygon they glued into their journals as an example.
Have students complete the Irregular Polygon Assessment.

## Extensions

Curriculum Extensions/Adaptations/ Integration
For students who have a difficult time using a ruler to measure, copy their trapezoid and irregular polygons on cm graph paper. This will be an easier way for them to find the area.
Show students examples of floor plans for homes on the Internet (or borrow some from a builder).
Explain to the students that floor plans are just big irregular polygons, and in order for a contractor to figure out how much material is needed for the house, he/she has to find the area of that plan. Have students design the floor plan of their own dream house on cm graph paper.
Family Connections
Have family help the students find the area of their dream house floor plan.
Have students show someone in their family how to decompose a trapezoid or polygon into different shapes in order to find the area.
Have students find the area of their own house.

## Assessment Plan

Informal assessment includes observation of student work, class discussion and journals.

- Trapezoid Assessment
- Irregular Polygon Assessment


## Bibliography

## Research Basis

Ball, D. (1991). What's all this talk about discourse? Professional Standards for Teaching Mathematics. National Council of Teachers of Mathematics, 1991.
Deborah Ball defines "discourse" as described by the NCTM Standards. A discussion from her classroom, along with entries from her teaching journal, illustrate how thoughtful discourse can be used to help students learn to discuss and understand mathematic concepts.
Bryant, V.A. (1992). Improving Mathematics Achievement of At-Risk and Targeted Students in Grades 4-6 Through the Use of Manipulatives. ERIC Source (ERIC \#ED355107). Retrieved December 10, 2007, from http://eric.ed.gov./
This document presents a study designed to improve mathematics achievement in grades 4-6 through the use of manipulatives. The primary goal was to provide mathematics manipulatives that would assist in helping at-risk and targeted students. Results indicated improvement on test scores, report card grades, and use of mathematics manipulatives.

## Authors

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