

Math for All Learners

Geometry

by

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To the Teacher

Since the early 1970s, we have been teaching math to learners of all ages, from young children to adults, who represent many different cultures and socioeconomic backgrounds. We believe that all learners *can* do math by first overcoming any math anxiety and then by participating in meaningful, cooperative learning activities that relate to various learning modalities (e.g., auditory, visual, kinesthetic, and tactile) of each learner.

With the release of the NCTM Standards in 1988 and in 2000 the NCTM Principles and Standards for School Mathematics, teaching mathematics has become more student-driven and hands-on. Emphasis on deductive and inductive reasoning through a discovery process enables a student to truly *understand* mathematics. We feel the labs presented in this book address these concerns. First, our labs address students' various learning styles. We provide hands-on activities of measuring, constructions, etc., which address the kinesthetic learner. We give opportunities to write and communicate ideas and to visualize concepts, thus including the visual learner. Finally, we furnish opportunities for group discussions and talking through problems, enabling the auditory student to be involved.

The study of Euclidean geometry lends itself to discovery of theorems through hands-on applications. Students who derive their own meaning for various theorems will own them and will understand what the theorems mean.

We hope you enjoy trying these activities with your students. We believe learning should be learner-centered, not teacher-driven. As quoted in the NCTM Principles and Standards, "students should conduct . . . explorations which will allow them to develop a deeper understanding of important geometric ideas. . . ."

—Pam and Judy

Area of a Parallelogram and a Trapezoid

Learning Outcomes

Students will be able to

- develop the formulas for the area of a parallelogram and the area of a trapezoid.
- identify the base and height for a parallelogram and trapezoid.
- understand the concept of area as square units.

Overview

Students will work with cutout trapezoids and parallelograms to discover area formulas.

Time Requirements

30 minutes

Group Size

Pairs

Materials

- parallelogram and trapezoid shapes (see page 37)
- scissors
- tape

Procedure

Part One

Area of a Parallelogram

1. Distribute photocopied parallelograms and trapezoids from page 37 for each pair of students. Each student should have one parallelogram and two identical trapezoids to cut out.
2. Make sure the students label the base and the height of the cutout parallelogram correctly before they begin to separate the parallelogram along its height.

3. Some students may need help in turning their pieces to form a rectangle. The cut pieces will form a rectangle as shown below.

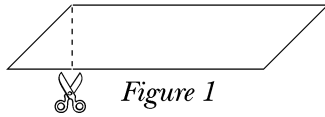


Figure 1

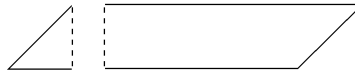


Figure 2

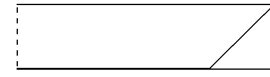


Figure 3

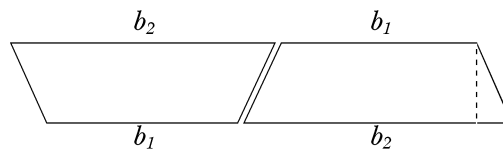
Answers

4. Base times height or $b \times h$
5. Yes, because the base and height are the same for the original parallelogram as they are for the newly formed rectangle.
6. $A = bh$

Part Two

Area of a Trapezoid

1. Pass out the photocopied trapezoids. Each student should receive two identical trapezoids to cut out.
2. Make sure the students have correctly labeled the parallel bases as well as the height.
3. The two trapezoids will form a large parallelogram as shown below.



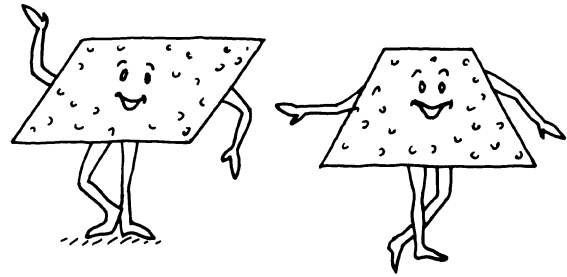
Answers

4. $b_1 + b_2$
5. h
6. $A = bh$
7. $A = (b_1 + b_2)h$
8. $A = \frac{1}{2}(b_1 + b_2)h$

ACTIVITY 7

Area of a Parallelogram and a Trapezoid

Part One



Area of a Parallelogram

You and your partner will each be given a **parallelogram** that has the height shown by a dotted line and the base as the side the height is drawn perpendicular to. Cut out each shape and label as follows:

1. Label the base *b* and the height *h* of your parallelogram.
2. Carefully separate the parallelogram by cutting along the dotted line, the *height*.
3. Rearrange the two pieces to form a rectangle. Tape the newly formed rectangle below. Then outside the rectangle, label the length as *b* and the width as *h*.

4. How can you find the area of the rectangle you have just formed? _____

5. Will the area of the original parallelogram be the same as the area of the rectangle you just formed? Explain. _____

6. What do you think might be a formula for finding the area of a parallelogram? Write your formula. _____

(continued)



ACTIVITY 7

Area of a Parallelogram and a Trapezoid *(continued)*

Part Two

Area of a Trapezoid

You and your partner will each be given identical **trapezoids**. Cut out each shape and label as follows:

1. Label the shorter parallel side b_1 and the longer parallel side b_2 .
2. Label the height in each of the trapezoids as h . Remember the height is always drawn from one base **perpendicular** to the other base.
3. Arrange the two trapezoids to form a parallelogram. Tape the pieces below.
4. For this parallelogram you have just formed, how would you express the base of this parallelogram in terms of b_1 and b_2 ? _____
5. What is the height of this parallelogram? _____
6. What is the area for any parallelogram? _____
7. Using the base from #4 and the height from #5, what is the area of your parallelogram shape? _____
8. Because the formula in #7 finds the area of two trapezoids together, discuss with your partner what the area of one trapezoid would be and write your answer here.

(continued)



ACTIVITY 7

Area of a Parallelogram and a Trapezoid *(continued)*

