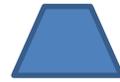# FINDING A FORMULA FOR THE AREA OF TRAPEZOID

Introduction and Background

In order to make the task of finding the area of a polygon more efficient, geometers over the years have developed formulas that can be memorized and then applied to problem solving situations. The formulas take what is known about the shape, the length of its sides, and uses that information to find the area.

In this activity, you will explore the trapezoid, make observations, and, just like geometers before you, develop a formula which can be used to find the area of any trapezoid.

Since you already know the formula for a triangle and a rectangle or other parallelogram,
- **area of a triangle = ½ X base X height**
- **area of a rectangle or other parallelogram = base X height**

let's try to find a way to modify a trapezoid so that either of these formulas might help find the area of a trapezoid.

Step 1. A Congruent Clone

On the *GeoGebra* page there is a blue trapezoid. Notice that this quadrilateral is a trapezoid because it has only one pair of parallel sides.

Click on **View the Clone** checkbox to create a red clone of the blue trapezoid. This red clone is *congruent* with the blue trapezoid. *Congruent* means identical – same points, same sides, same angles.

Step 1. Experiment

Use the MOVE tool to move and rotate the red trapezoid (using the Rotator Point), connecting it in some way to the blue trapezoid so that you form a triangle, rectangle, or other parallelogram.

Step 2. Find the Area of the Trapezoid

With a few tries you should be able to create a large parallelogram formed from rotating the clone trapezoid placing the two congruent trapezoids end-to-end.

We know the formula for a parallelogram, so this construction can give you some clues about how to compute the area of a trapezoid.

If the **area of a parallelogram = base X height**, then we only need to know the base and the height of our new parallelogram to compute its area.

Turn on the GRID and use the grid to measure the base and height of the new parallelogram and compute its area:

Parallelogram Base =   _____ units

Parallelogram Height = _____ units

Parallelogram Area =   _____ square units

This is fine for the parallelogram, but what is the area of the trapezoid? Remember, the original trapezoid is only ½ as large as the parallelogram.

Trapezoid Area = ½ the area of Parallelogram = _____ square units

Step 3. So, What's the Formula?

So, if you know the dimensions of the trapezoid, its base and its height, how can you use that information in a formula to find its area?

Remember, the formula for the area of the parallelogram is:

Area of the parallelogram = base X height

Remember also that the area of the trapezoid, what we really want to know, is half of this area.

Knowing the height of our new parallelogram is no problem. It's the same height as the trapezoid.

Notice that the base of the new parallelogram is actually the sum of the original trapezoid's Side A and Side B. Use that information to rewrite the formula for the area of the parallelogram:

Area of the parallelogram = (trapezoid's Side A + trapezoid's Side B) X trapezoid's height

Since the area of the trapezoid is half of the area of the parallelogram, we now have our formula for the area of a trapezoid:

Area of a Trapezoid = ½ X (Side A + Side B) X height