

# Parallel Pairs: Parallelogram and Triangle Area

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**Description:** Students explore the relationship between the areas of parallelograms and triangles using a process called shearing. Students discover that shearing does not affect the area, but changing the lengths of the height and base does. Based on their observations, students write formulas for area of a parallelogram and area of a triangle.

**Technology Strength:** Students construct a parallelogram and change it dynamically to see the effects on the area measurement. Students use the Sketchpad Calculator to test an expression for the area of a parallelogram. This calculation updates as the parallelogram changes. Then students construct a triangle with the same base and height as the parallelogram to explore the relationship between the area of a parallelogram and the area of a triangle. This helps them write a formula for the area of a triangle.

**Objectives:** Learn that the area of a parallelogram is the product of its base and height and that the area of a triangle is one-half the product of its base and height

**Prerequisites:** Understanding of the terms area and parallelogram and the terms height and base as they apply to parallelograms and triangles

**Suggested Grade Level:** 6 to 8

**Sketchpad Level:** Beginning

**Suggested Duration:** 45 minutes

**Suggested Classroom Setting:** Whole Class, Student Pairs. This activity, designed for use by student pairs, can be easily modified for whole-class use.

**Preparation:** Review the Activity Notes. Work through the steps on the worksheet and make a copy of the worksheet for each student. See the presentation sketch for an example of completed student work. Decide whether to give students the optional student sketch or have them construct their own parallelograms.

**Materials:** None

**Student Worksheet(s):** Parallel Pairs

**Student Sketch:** Parallel Pairs.gsp

**Presentation Sketch:** Parallel Pairs Present.gsp

**Vocabulary:** Parallelogram, triangle, base, height, area, shearing

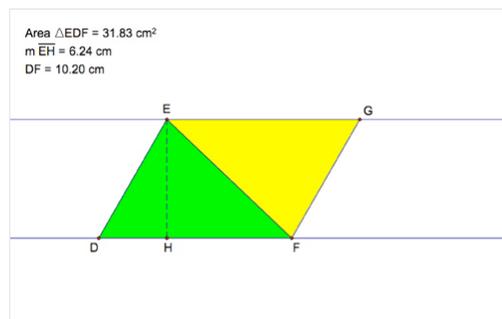
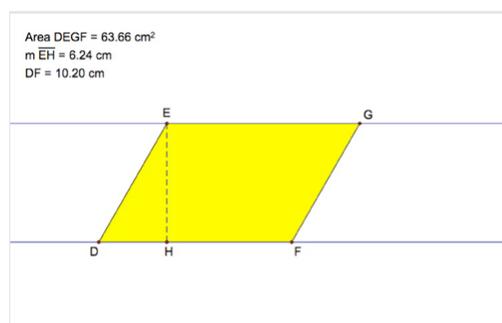
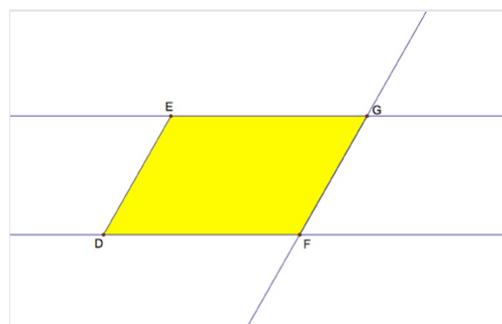
**Sketchpad Version:** GSP5

## Using the Sketch:

Students construct a parallelogram by following specific steps that result in two pairs of parallel lines. The first illustration shows the student construction after they have constructed the interior of the parallelogram. Students then measure its area.

Next, students construct an altitude and measure the height and base, as shown in the second illustration. By dragging various points and sides of the parallelogram, students investigate which measurements affect the area. Then students enter measurements in the Calculator to find an expression equal to the area.

By adding a diagonal to the parallelogram, students then construct a triangle with the same base and height as the parallelogram, as shown in the third illustration. Students explore the relationship between the area of the triangle and the area of the parallelogram and arrive at area formulas for both shapes.



## Sketch Tips:

Sketch Tips show skills needed in this activity, and the step at which the skill is first used.

| Sketch Tip  | Tip Sheet or Tip Video                       |
|---|--|
| Step 1: Change Sketchpad's settings using <b>Edit   Preferences</b>                 | Setting Preferences                          |
| Step 2: Construct a segment, ray, or line with the <b>Straightedge</b> tool         | Using the Straightedge Tool                  |
| Step 3: Construct a point with the <b>Point</b> tool                                | Using the Point Tool                         |
| Step 4: Select, deselect, and drag objects with the <b>Arrow</b> tool               | Using the Arrow Tool                         |
| Step 4: Construct a parallel line using <b>Construct   Parallel Line</b>            | Constructing Parallels and Perpendiculars    |
| Step 5: Hide an object using <b>Display   Hide</b>                                  | Deleting and Hiding                          |
| Step 7: Construct a point on an object with the <b>Point</b> tool                   | Using the Point Tool                         |
| Step 10: Construct a polygon interior using <b>Construct   Interior</b>             | Constructing Interiors                       |
| Step 13: Measure an area using <b>Measure   Area</b>                                | Measuring Area, Perimeter, and Circumference |
| Step 16: Construct a perpendicular line using <b>Construct   Perpendicular Line</b> | Constructing Parallels and Perpendiculars    |
| Step 19: Measure the length of a segment using <b>Measure   Length</b>              | Measuring Length and Distance                |
| Step 20: Measure a distance using <b>Measure   Distance</b>                         | Measuring Length and Distance                |
| Step 21: Calculate an expression using <b>Number   Calculate</b>                    | Using the Calculator                         |
| Step 21: Click a value in the sketch to enter it into the Calculator                | Using the Calculator                         |

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| Step 29: Create an Animation button using <b>Edit   Action Buttons   Animation</b> | Animating |
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