

**Lesson Title: Areas of Triangles, Parallelograms, Trapezoids Pre 8.1****Utah State Core** Pre-algebra Content Standard 4 Process Standards 3-5**Summary**

In this lesson, students use 3x5 cards to develop the formulas for finding the areas of triangles, parallelograms, and trapezoids. First they find the area of the 3x5 card. Then they relate the area of two triangles with the same base and height as the card (another card is cut to make these triangles). Then they do the same with parallelograms and trapezoids. They develop the formulas for finding the areas of these shapes using their own reasoning and understanding.

**Enduring Understanding**

Geometry enables us to describe, analyze, and understand our physical world. We derive formulas by analyzing what we know and then generalizing.

**Essential Questions**

- Where do formulas come from?
- How are the formulas for the area of parallelograms, triangles, trapezoids, and regular polygons related?

**Skill Focus**

- Developing formulas to find areas of parallelograms, triangles, trapezoids
- Relating area formulas of different polygons

**Vocabulary Focus**

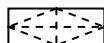
base, height, rectangle, triangle, parallelogram, trapezoid

**Materials** Colored 3x5 cards, 5 colors—each student will receive one of each color, graph paper, Geometer’s Sketchpad, Patty Paper

**Launch****Explore****Summarize****Apply****Assess****Teacher Information**

If desired, have students record their work on the area worksheets. Another possibility is to have the students tape their cards onto a sheet of paper and explain the area formulas.

To extend to the area of a rhombus, draw as shown below. Students will see that the area is  $\frac{1}{2}$  of the rectangle. In order to derive the formula, suggest they label the diagonals of the rhombus as  $d_1$ (length) and  $d_2$ (width) and use them in the formula.



See also:

- Patty Paper Geometry, Area Formulas for parallelograms, triangles, trapezoids, circles pages 201-204 or 206-207
- Exploring Geometry with Geometer's Sketchpad
  - \*Area of Parallelograms and triangles page 133
  - A Triangle Area Problem page 135
  - A Square Within a Square p.137
  - A Triangle Within a Square p. 139
  - A rectangle with maximum area p. 140
  - Dividing Land p. 144

## Pre 8.1

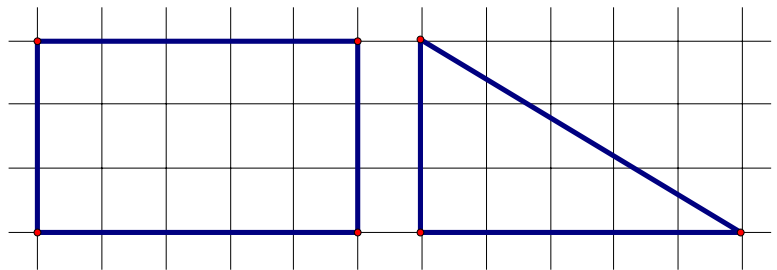
## Areas of Triangles, Parallelograms, Trapezoids

You have been given a set of 3 x 5 cards which you will be cutting to create examples for the problems below. Make certain to keep all of your examples—they will be proof of your answers. You will need to use the examples to explain your thinking.

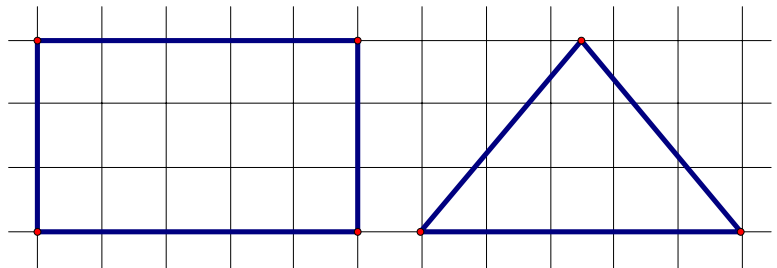
1) Mark off the perimeter of the cards in inches—draw the grid to create square inches on the card. What is the area of the card? \_\_\_\_\_ How is the area of the 3 x 5 card related to the base and height of the rectangle?

2) Cut three cards to create the triangles shown below.

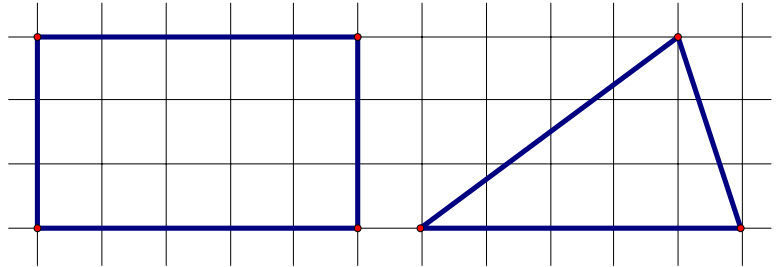
a) How is the area of the triangle related to the area of the rectangle?



b) How is the area of the triangle related to the area of the rectangle? How do you know?



c) How is the area of the triangle related to the area of the rectangle? How do you know?

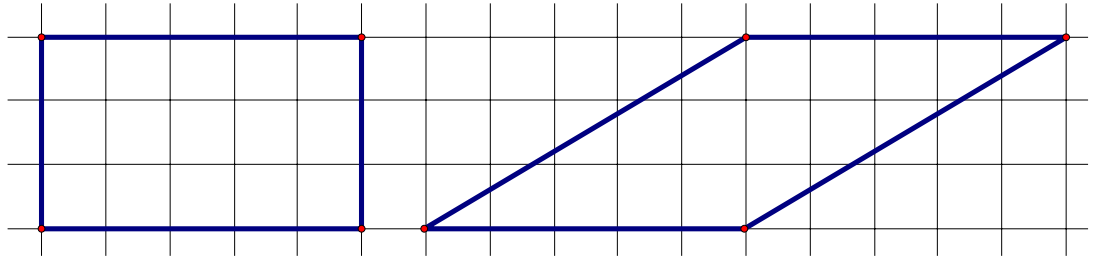
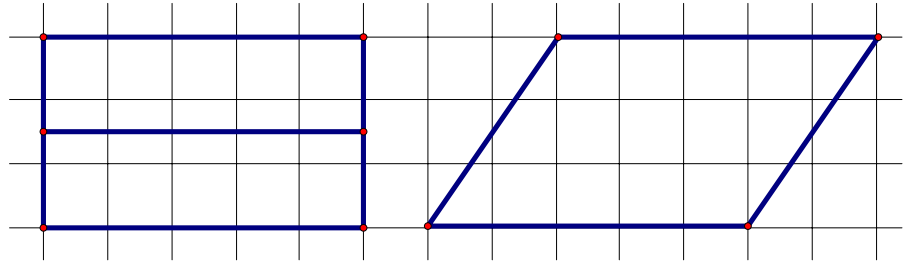


d) From these three examples, what is your method for finding the area of a triangle?

Triangle area = \_\_\_\_\_ (What is your formula?)

3) Examine the relationship between parallelogram and rectangle areas. Use two more cards to help you—you may need to use some scotch tape also.

- a) What is the base of the parallelograms? \_\_\_\_\_  
 What is the height? \_\_\_\_\_  
 How are the areas of the parallelograms related to the area of the rectangle? How do you know?

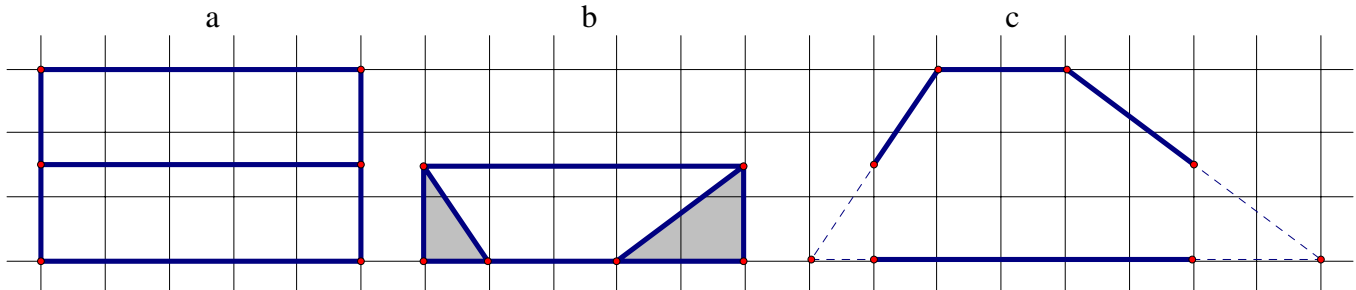


- b) From these two examples, what is your method for finding the area of a parallelogram?

Area of a parallelogram = \_\_\_\_\_ (What is your formula?)

4) Examine the relationship between trapezoid and rectangle areas. Your task is to test and explain the formula for finding the area of a trapezoid. Area of a trapezoid =  $\frac{1}{2} (B_1 + B_2)h$

Use your next 3 x 5 card. Mark  $\frac{1}{2}$  on the widths of the card (see a below). Fold the card at these two points. Cut a triangle off both ends of the folded over layer (see b below). Then tape the cut off sections on both sides to create a trapezoid (see c below).



Test and explain the formula.

Explain how the area formulas for rectangles, triangles, parallelograms and trapezoids are related. Use examples and pictures if desired.