

Area, Perimeter, and Ratios Using Pentominoes

Overview:

Students will, through exploration develop the set of pentominoes. Students will be able to calculate the perimeter and area of geometric shapes made with pentominoes. Students will be able to compare similar figures and write ratios that relate one geometric shape with another.

Benchmarks

3-4th grades

Geometry and Spatial Sense

- A. Comparison of two-dimensional figures

Measurement

- A. Select appropriate units for perimeter and area
- D. Apply counting techniques for measuring perimeter and area.

5-7th grades

Measurement

- C. Apply appropriate techniques for measuring perimeter and area.
- E. Use problem solving techniques to solve problems involving area and perimeter.
- F. Analyze and explain what happens to area and perimeter when dimensions of an object change.

Geometry and Spatial Sense

- E. Use proportions to express relationships among corresponding parts of similar figures.

8-10th grades

Measurement

- C. Apply indirect measurement techniques to find perimeter and area.
- D. Describe and apply properties of similar and congruent figures.

Materials: Students will need blank paper, a set of pentominoes, graph paper, worksheets.

Procedure:

- 1) Give students a blank sheet of paper and have them divide it in half lengthwise and then into thirds to create six congruent “Squares”.
- 2) Have students determine how many different configurations can be made using five squares and have them record their findings on graph paper.
- 3) Give students a set of pentominoes to see if they found all possible configurations.

- 4) Discuss the area of each pentominoe and ask students if they think the perimeter will be the same for all pentominoes. Why or why not?
- 5) Have students find the perimeter of each pentominoe by counting.
- 6) Give students a set of geometric shapes and have them cover all with one set of pentominoes finding the area and perimeter of each shape. Ask students how the area of each pentominoe relates to the total picture in terms of area.
- 7) Ask students if they can form a rectangle with various number of pieces and have them complete the Rectangle worksheet. Ask students if they see a pattern.
- 8) Ask students how many different squares can be formed using pentominoes. Why is there only one?
- 9) Give students various area/perimeter directions and ask them to form a geometric shape that meets the given directions. Ex. Form a figure with area 20 and perimeter 22. Form a figure with area 35 and perimeter 34. Form a figure with area 30 and perimeter 25. Discuss what is possible and what isn't and why.
- 10) Have students find the L shaped piece. Determine its dimensions. Ask students if they can start with that piece and create a similar figure that has a 2 to 1 ratio to the L piece. Find the perimeter and area of the similar figure. Discuss the ratio between the perimeters of the two shapes and the areas of the two L shapes.
- 11) Have students find the straight pentominoe and establish its dimensions. Ask students if they can create a similar figure that has a ratio of 2 to 1 to this piece using pentominoes.
- 12) Discuss congruent figures. Ask students to take two pieces and create a shape. Ask students if they can find two other pentominoes that will create a congruent shape. How will they know if the shapes are congruent?

Extensions:

- Have students take the six squares originally formed and create all of the possible configurations using all six squares. These are called hexominoes.
- Have student create their own area/perimeter problems and have their classmates try to create them.
- Have students create a figure that they think looks like an animal and write a two paragraph story about their figure.
- Have students form a rectangle using all twelve pentominoes.

Assessment:

- Have students form figures and find the area and perimeter.
- Give students geometric shapes and have them cover them.

Congruent Figures

Two geometric figures are congruent if they have the same shape and the same size. Take two pentominoes and make a figure. Trace your figure below.

Find two different pentominoes that you did not use in the figure above and make a figure congruent to the one above. Trace the figure below. How did you decide the two figures were congruent?

Can you find another pair of pentominoes to form another congruent figure? If so, trace the third figure on the back of the sheet.

Rectangle Worksheet

Complete the following chart. If you can form a rectangle using the indicated number of pieces, write yes in the table. If you cannot form a rectangle using the indicated number of pieces, write no in the table.

Number of pieces	Can you form a rectangle?
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Look for a pattern that explains your answers.